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Reference

DEPARTMENT OF THE ARMY FIELD MANUAL**NONDIVISIONAL
ENGINEER COMBAT UNITS****HEADQUARTERS, DEPARTMENT OF THE ARMY****SEPTEMBER 1964**

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NONDIVISIONAL ENGINEER COMBAT UNITS

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*This manual supersedes FM 5-142, 20 March 1961.

CHAPTER 1

ROLE OF NONDIVISIONAL COMBAT ENGINEER UNITS

1-1. Purpose and Scope

a. This manual provides guidance and information in the employment and operations of nondivisional engineer combat units.

b. It outlines the mission, organization, equipment, capabilities, operations, employment, and training of the engineer brigade (army or corps); the engineer combat group; the engineer combat battalion (army); the engineer float bridge company; the engineer panel bridge company; and the engineer light equipment company. The engineer dump truck company, which is also discussed in FM 5-162 is included because of frequent attachment to these type units.

c. The material presented herein is applicable to limited and general war either nuclear or nonnuclear.

d. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and evaluation. Comments should be forwarded directly to the Commanding Officer, U.S. Army Combat Developments Command Engineer Agency, Fort Belvoir, Va. 22060.

1-2. Mission and Role

a. Nondivisional engineer combat units provide large-scale, coordinated engineer combat support for army, corps, and independent task force operations within a specified area or field of responsibility (fig. 1-1). Nondivisional engineer units work closely with division engineers in support of combat operations by accomplishing tasks which exceed, either by number or by nature, the capabilities of division engineer battalions.

b. Nondivisional engineer combat units participate and provide special staff assistance in the conduct of combat operations. Missions for which nondivisional engineers are particularly suited include—

- (1) Support of river-crossing operations including aid to amphibians and the provision of additional crossing means such as assault boats, ferries, and bridges.
- (2) Barrier and denial operations, including technical advice on methods and location, and assistance in the construction of obstacles requiring engineer skills and special equipment.
- (3) Construction, repair, and maintenance of routes including roads, bridges, cableways, and tramways.
- (4) Installation, repair, and recovery of flexible (assault) military pipelines.
- (5) Demolitions including atomic demolition munitions (ADM) when properly augmented by ADM teams.
- (6) Engineer support in the conduct of amphibious operations (FM 5-144).
- (7) Fight as a light infantry force in ground combat when required.
- (8) Construction and rehabilitation of railways.
- (9) Advice and assistance to using units in the construction of field fortifications; construction of emplacements and protective shelters which require the use of engineer earthmoving equipment; and increasing the effectiveness of fortified positions through the creation of obstacles.
- (10) Participation in the assault of fortified positions by breaching obstacles protecting the positions; marking and maintaining the lanes thus cre-

ated; and the destruction of enemy emplacements by demolition or other means.

- (11) Engineer reconnaissance. This mission is continuous and is a responsibility of all engineers, not just those personnel designated for the task. In addition to specific items of terrain and cross country movement information required to support an operation plan, engineers require knowledge of the condition and capacity of routes of communication and air-landing facilities; obstacles to friendly movement and suitable locations for construction of nuclear and nonnuclear defensive obstacles; the location of construction materials; possible locations for water points, and other local resources which can be used in furtherance of the engineer support mission.
- (12) Establishing and operating water points.
- (13) Construction, rehabilitation, repair, and maintenance of air-landing facilities.

c. The number and type of nondivisional engineer combat units required by the army or corps are determined by the overall mission, the size and characteristics of the area, the operational environment, and the nature and magnitude of engineer work to be performed. The requirements for engineer troops usually exceed the number of troops available. Good judgment is necessary, therefore, to insure that the troops available are used where they can best support the overall mission.

d. Occasionally, independent engineer combat units may be committed in counterinsurgency operations. These units may be organized into task forces to perform work requiring their special engineer skills and equipment and to provide training assistance and advice to host country engineer forces.

e. One of the missions of engineer combat units is to perform ground combat in an infantry role when required. The basic training of combat engineers parallels that of infantry with less time devoted to tactics and supporting weapons. This only means that engineer capabilities to perform in a ground combat role are reduced from those of a comparable infantry unit.

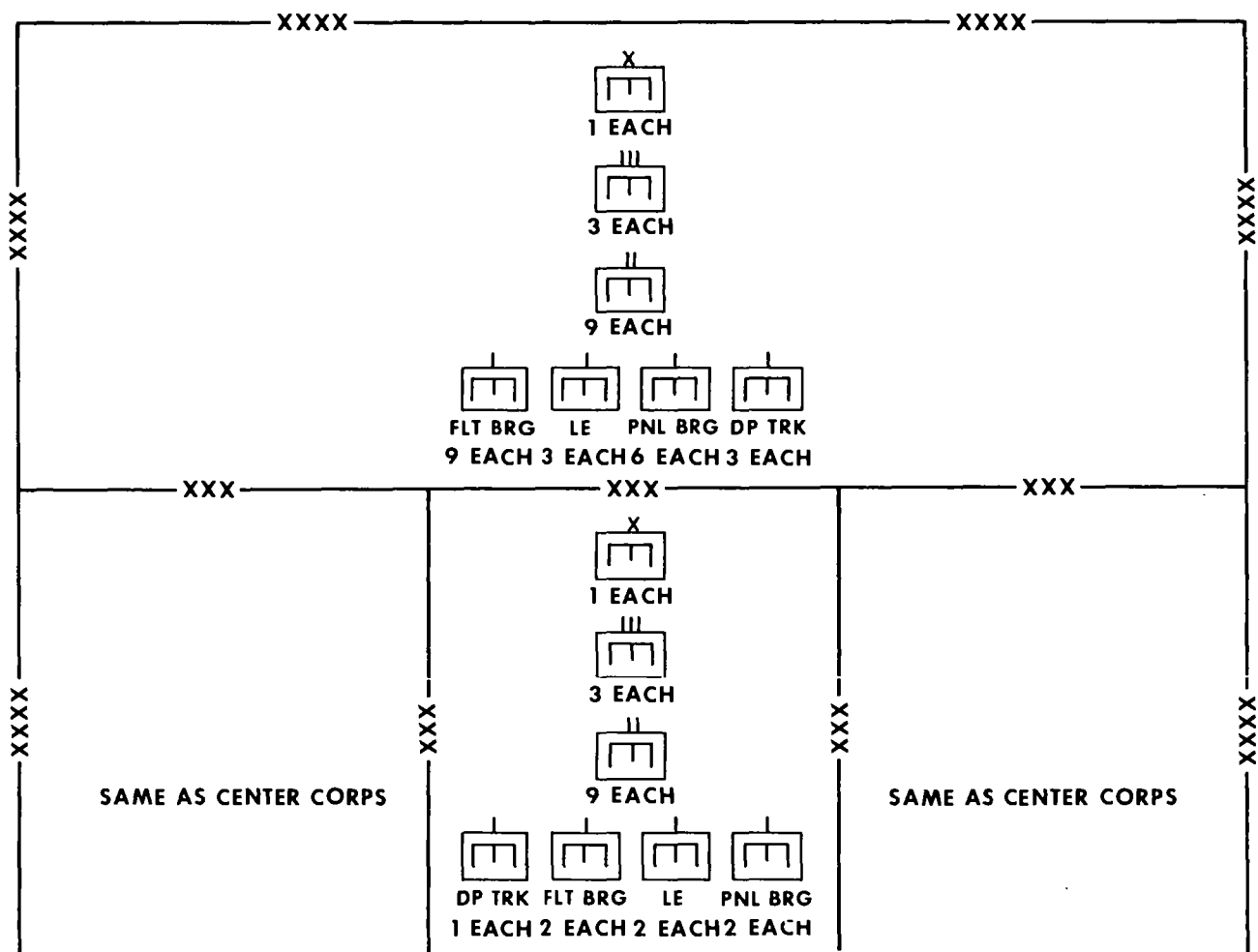


Figure 1-1. Allocation of engineer nondivisional and divisional combat units in a type field army.

CHAPTER 2

ENGINEER BRIGADE, ARMY OR CORPS

2-1. General

The largest engineer command assigned to a field army is the engineer brigade. The brigade is utilized to control and coordinate large-scale engineer operations. The term, engineer brigade, as used in this manual refers to the engineer brigade (army) and the engineer brigade (corps) and airborne corps as distinguished from the engineer construction brigade.

2-2. Organization

The engineer brigade is a flexible organization consisting of a headquarters and headquarters company and other attached engineer units, principally two or more engineer combat groups. Other engineer units may also be attached including engineer bridge, light equipment, camouflage, dump truck companies, and topographic units. Topographic units, however, perform a specialized intelligence function and are discussed in FM 5-146.

2-3. Mission

The mission of the engineer brigade (army, corps, or airborne corps) is to—

a. Command and coordinate the activities of nondivisional engineer combat and combat support units assigned to army or attached to corps or airborne corps in support of combat operations.

b. Provide an engineer staff section for the army, corps, or airborne corps headquarters.

2-4. Major Items of Equipment

Major items of equipment of the engineer brigade are listed in appropriate TOE of the attached units. The equipment of headquarters and headquarters company, engineer brigade is largely individual; it consists of that equipment required for administrative support, security, command, and control.

2-5. Mobility

Headquarters and headquarters company, engineer brigade is fully mobile and 100 percent air transportable. In general, attached engineer units are also completely mobile; air transportability, however, is dependent on the type of unit and the phase of the airlift operation (FM 101-10 and AR 705-35).

2-6. Assignment

Normally, one engineer brigade is assigned to each field army and one is assigned or attached to each corps or airborne corps.

2-7. Capabilities

The capabilities of the engineer brigade (army, corps, or airborne corps) are the sum of the capabilities of its attached units.

2-8. Employment

In modern tactical operations, larger operational areas and greater destructive power of weapons increase the requirement for engineer support. Engineer effort must be more flexible than in the past and immediately responsive to the combat support requirements of dispersed and rapidly moving tactical elements. An engineer brigade headquarters operating in each corps or airborne corps and one in the field army provide the command, control, and staff planning necessary for this support. Elements of the engineer brigade (corps or airborne corps) operate primarily on an area assignment basis within the corps area of responsibility. Corps engineer units frequently take over tasks in division areas, either by attachment to or support of the division. Operations of these units are coordinated by the division commander through his division engineer. The engineer brigade (army) provides general engineer combat support to the field army. Additionally, elements of the engineer

brigade (army) operate from the army rear boundary forward into the corps area on both an area and task assignment basis; however, operations forward of the corps rear boundary are coordinated by the corps commander through the corps engineer. An engineer brigade may also be attached to or operate as a part of an independent task force.

2-9. Army and Corps Engineers

a. Dual Role of the Engineer Brigade Commander. The commander of the engineer brigade performs a dual role: He commands all engineer troops attached to the brigade and, in addition, serves as the staff engineer to the army or corps to which his brigade is assigned. The commander of the engineer brigade (army) is assisted and represented at army headquarters by a deputy army engineer, who supervises the army engineer section. The army engineer section of the brigade functions as an integral part of the army headquarters. In addition to representing the brigade commander, the deputy army engineer performs duties relating to engineer staff planning and assistance. Within the army area, the engineer brigade commander controls and coordinates all engineer combat and combat support activities. This includes the activities of all other engineer units sent into the army area to perform task assignments. Coordination with the corps is accomplished through the corps engineer brigade commanders, who are similarly assisted by deputy corps engineers and engineer staff sections at corps headquarters. In the corps area, the brigade commander controls and coordinates all nondivisional engineer combat support activities. Engineer brigade elements operating forward into divisional areas coordinate their activities with the division engineer through their combat group headquarters unless attached to or in direct support of a division, in which case they coordinate directly with the division engineer.

b. Nuclear Weapons and ADM Employment.

- (1) If the use of nuclear weapons or atomic demolition munitions is contemplated, the engineer brigade commander, acting in the capacity of staff engineer, participates in preliminary conferences in which methods of

carrying out the commander's plan are discussed. Targets and delivery means are considered and the engineer, when appropriate, presents reasons for retention or elimination of specific targets. The engineer is particularly concerned with the effects of nuclear strikes on terrain (obstacles caused by cratering, tree blowdown, or radiological contamination) and the influence of these effects on the overall tactical plan and engineering requirements. He may assist in the analysis of likely targets and propose employment of atomic demolition munitions in accordance with the following recommendations.

- (a) Quantity, type, and yield of weapons.
 - (b) Height or depth of burst.
 - (c) Desired emplacement site location.
 - (d) On-call detonation or times of bursts.
 - (e) Troop and civilian safety precautions.
- (2) When the commander decides to employ atomic demolition munitions, the engineer recommends the tactical organization to control the mission. Normally the mission will be assigned to the division responsible for the area in which the demolition sites are located. The mission may be accomplished by the division with its organic capability; however, if the number of demolitions warrant, the engineer recommends attachment of ADM teams to the division. If the demolition site is not in a division area, the engineer recommends the control arrangements appropriate to the circumstances and designates the emplacing and firing unit. The control organization may be a major tactical organization such as an armored cavalry or separate brigade or an engineer group. In unusual situations which require direct control of the demolition by the commander, the engineer recommends formation of a demolition task force and designates

the engineer elements of the task force (FM 31-10). Unless the mission has been assigned to a division, which has an organic ADM capability, the engineer is also responsible for the supply and movement of the equipment, material, and personnel to support the ADM mission (FM 5-26). The capability of the engineer brigade to support multiple ADM operations is dependent upon the number of ADM teams (TOE 5-500) which have been attached to the brigade.

2-10. Headquarters and Headquarters Company, Engineer Brigade

This company is organized under TOE 5-101 and provides the command and staff elements of the brigade and the necessary personnel required to perform the operational planning, coordination and supervision for attached engineer combat and combat support units in the accomplishment of engineer missions in support of army or corps operations (fig. 2-1).

a. Brigade Headquarters. Provides the command and major staff officers of the brigade. The brigade commander is assisted by the following staff: executive officer, adjutant (S1), intelligence officer (S2), operations officer (S3), supply officer (S4), aviation officer, communications officer, aide, and sergeant major. Staff officers' duties are guided by the desires of the commander and as generally outlined in FM 101-5, FM 5-1, and AR 611-101. Information pertinent to the duties of enlisted members of the various staff sections is discussed in AR 611-201.

b. Company Headquarters. This element provides the command, administration, mess, supply and organizational maintenance (less aircraft maintenance) for the headquarters and headquarters company. The personnel assigned to this company are organized into staff sections and operate under the supervision of the appropriate staff officer; however, the company commander is responsible for unit training. Additionally, the company commander performs the function of headquarters commandant.

c. Administrative Section. This section, under the supervision of the brigade adjutant (S1),

performs the administrative functions of the brigade headquarters. It exercises staff supervision over and inspects the administrative activities of subordinate units and advises the brigade commander and subordinate units on administrative matters. The personnel staff NCO maintains close liaison with the army or corps administration company regarding assignment of personnel and other administrative matters.

d. Intelligence Section. This section, under the supervision of the intelligence officer (S2), collects, evaluates, and disseminates intelligence information with emphasis on engineer aspects. The collection effort is coordinated with higher, adjacent, and subordinate headquarters. It assists and advises the brigade commander and subordinate units in matters relating to intelligence and counterintelligence. A terrain intelligence analyst is assigned the additional duty of photographer to provide this section with the capability of photographing engineer operations and supporting reconnaissance activities.

e. Operations Section. This section, under the supervision of the operations officer (S3), prepares operations orders and directives for dissemination to subordinate units. It supervises, plans, controls and coordinates engineer combat and combat support missions to include atomic demolition munitions employment. It prepares estimates of material, equipment, and manpower requirements as well as organizational and training requirements. It maintains close coordination with the engineer section at army or corps.

f. Supply and Maintenance Section. This section, under the supervision of the brigade supply officer (S4), inspects, supervises, and coordinates the brigade supply and maintenance activities. It assists and advises subordinate units in overcoming problems in maintenance, supply, and repair parts acquisition. It advises the brigade commander on matters pertaining to supply and maintenance.

g. Communications Section. This section, under the supervision of the communications officer, provides the necessary personnel and equipment for installation and operation of the brigade communications center. The center contains radio (Bde NCS) (fig. 2-2), teletype-

writer, and wire facilities for communication with subordinate units and with adjacent and higher headquarters (fig. 2-3). The communications officer, as a staff officer, is responsible for coordinating communications facilities throughout the brigade. He also maintains direct liaison and coordination with supporting signal units for additional means of communications when required. In situations where attached engineer units are dispersed, communication is normally maintained through the area communications system.

h. Aviation Section. This section, under the supervision of the aviation officer, operates and maintains the authorized aircraft. The aircraft are used principally as a means to extend effective command and control to widely dispersed subordinate units, as well as use as reconnaissance vehicles.

i. Army or Corps Engineer Section.

(1) This section, under the supervision of the deputy staff engineer, represents the brigade commander (who is also the army or corps engineer) at army or corps headquarters and assists in executing his staff responsibilities to include:

- (a) Advising the army or corps commander and staff on engineer matters.
- (b) Coordinating and planning the allocation of engineer combat and combat support within the area of responsibility.

(c) Coordinating engineer intelligence and topographic support for army units in conjunction with the G2, G3, and Artillery Officer.

(d) Providing assistance to the G3 in the preparation of operations orders and plans to include planning for nuclear weapon and atomic demolition munition employment.

(e) Providing assistance to army G4 in the preparation of administrative orders and plans.

(f) Preparing engineer annexes to operations orders and plans in conjunction with the brigade staff.

(2) In situations where there are too few engineer units to justify the formation of an engineer brigade, the army or corps engineer section of the brigade headquarters, minus the brigade headquarters and headquarters company, must be activated in order to provide the army or corps headquarters with an engineer section.

j. Headquarters and Headquarters Company, Engineer Brigade. The headquarters and headquarters company, engineer brigade is dependent upon army or corps supporting elements for.

(1) Personnel services.

(2) Religious services.

(3) Medical services.

(4) Communications, when the requirements exceed organic capability.

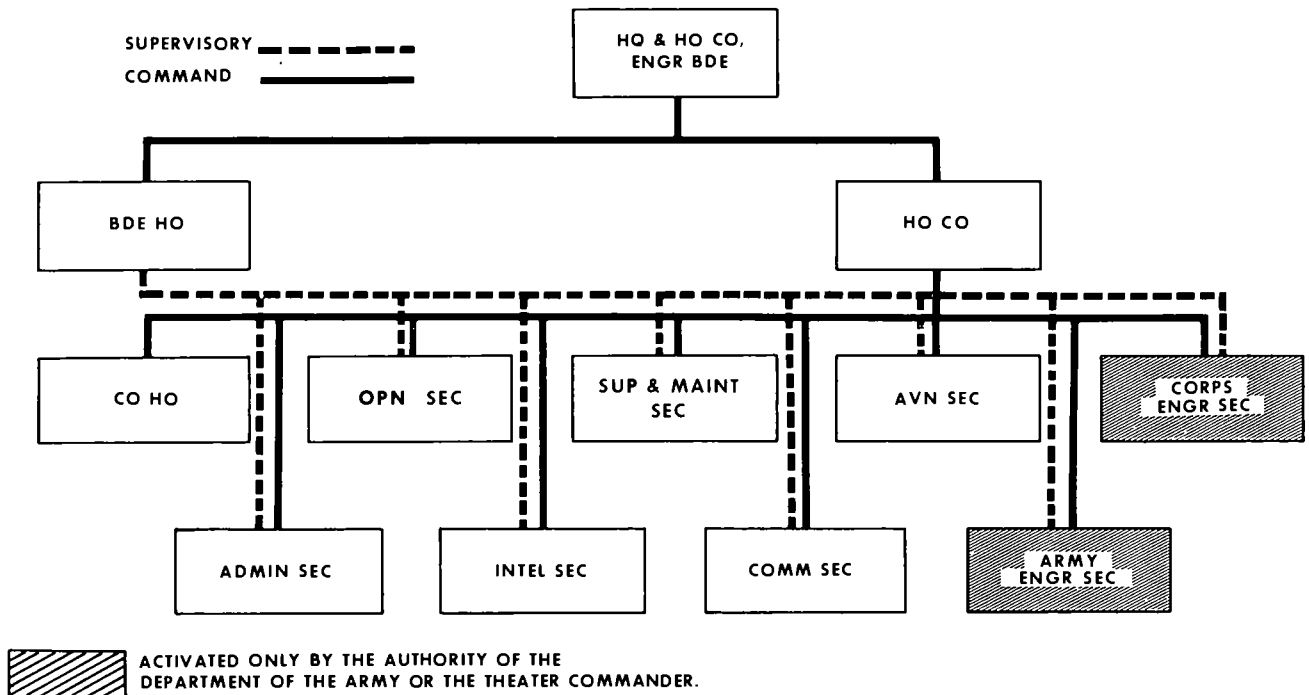


Figure 2-1. Organizational chart, headquarters and headquarters company, engineer brigade (army or corps).

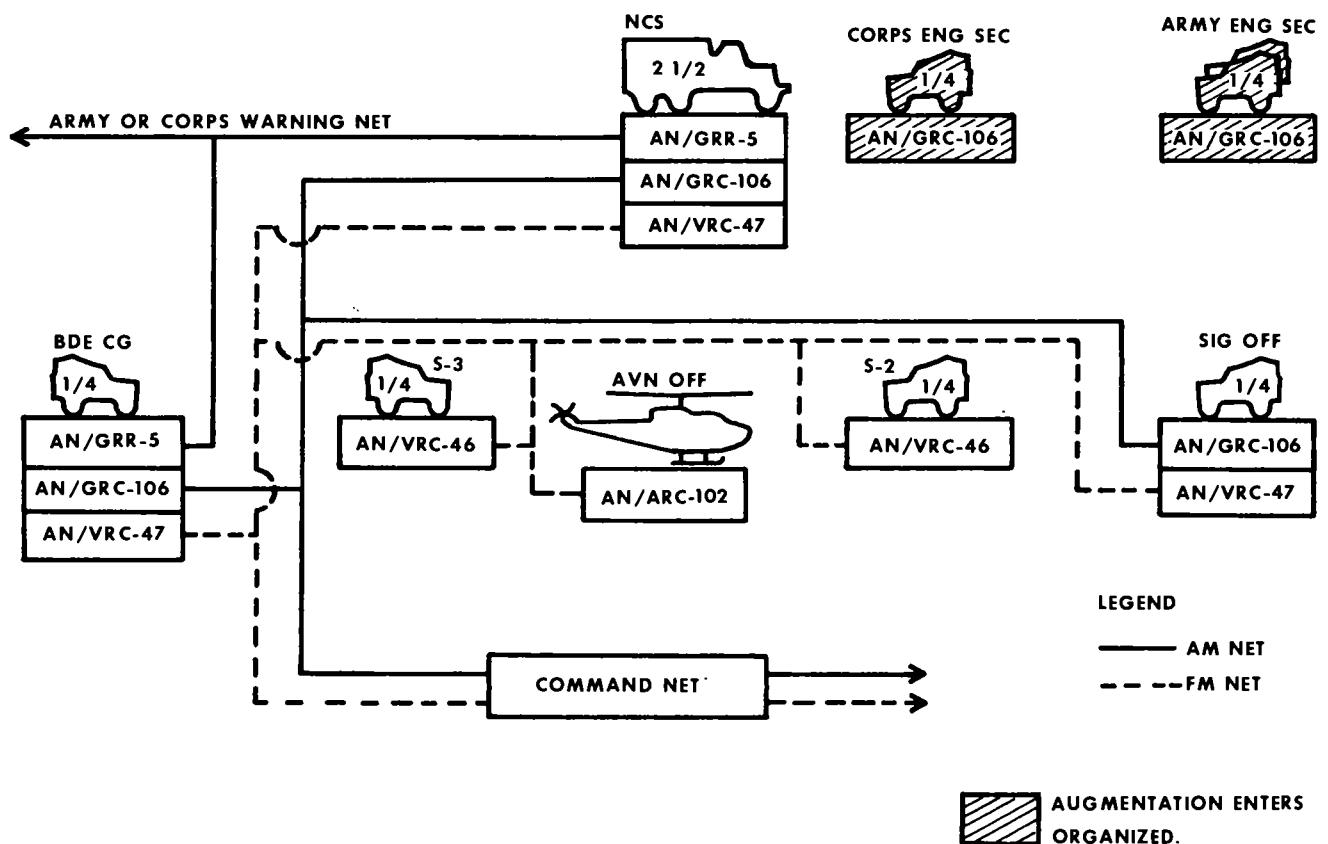


Figure 2-2. Typical radio net, engineer brigade (army or corps).

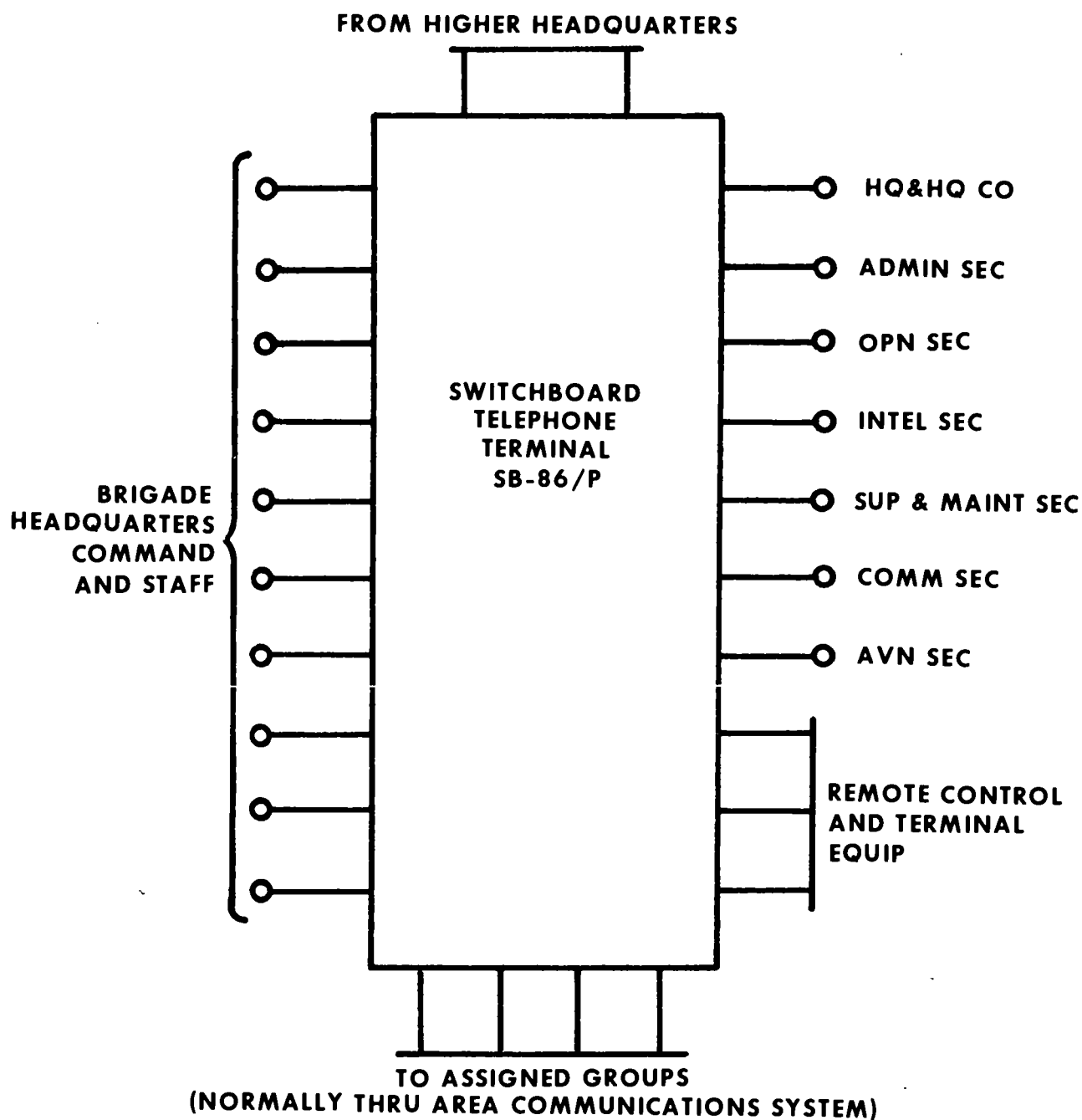


Figure 2-3. Typical wire diagram, engineer brigade (army or corps).

CHAPTER 3

ENGINEER COMBAT GROUP

3-1. General

The major nondivisional engineer combat unit attached to an engineer brigade (army or corps) is the engineer combat group. The term, engineer group, as used in this manual refers to the engineer combat group as differentiated from the engineer construction group.

3-2. Organization

Like the engineer brigade, the engineer combat group is a flexible organization consisting of a headquarters and headquarters company to which other engineer units are attached in accordance with the overall mission, operational environment, type and amount of engineer support required, and the engineer units available. A typical engineer group may consist of three engineer combat battalions (army), one engineer light equipment company, one engineer panel bridge company, one engineer float bridge company, and one engineer dump truck company.

3-3. Mission

The mission of the engineer combat group is to command attached units, thereby coordinating their tactical, technical, and administrative operations.

3-4. Major Items of Equipment

Major items of equipment of the engineer combat group are listed in appropriate TOE of the attached engineer units. The equipment of the headquarters and headquarters company, engineer combat group is largely individual and that required for administrative support, security, command, and control.

3-5. Mobility

The headquarters and headquarters company, engineer combat group is fully mobile and 100 percent air transportable. In general,

attached engineer units are also completely mobile; however, air transportability is dependent on the type of unit and the phase of the airlift operation (FM 101-10 and AR 705-35).

3-6. Assignment

Normal assignment of an engineer combat group is to a field army or independent corps with further attachment to an engineer brigade. Normally, two to three engineer combat groups are attached to the engineer brigade (corps) and three to four engineer combat groups are attached to the engineer brigade (army).

3-7. Capabilities

The capabilities of the engineer combat group are the sum of the capabilities of its attached units.

3-8. Employment

The engineer combat group normally operates as part of a brigade although it may operate directly under corps or army or independently in a special task force assignment. The corps engineer combat group usually operates from the corps rear boundary forward into the divisional area, primarily on an area assignment basis. Routine support is coordinated at battalion level; major operations, however, are coordinated by the engineer group or brigade headquarters with the supported organizations. Corps engineer combat battalions or the entire group may occasionally be placed in direct support of or even attached to a division. In a direct support role or upon attachment, the supporting battalion or group commander coordinates with the division commander, normally through the division engineer. The army engineer combat group generally operates from the army rear boundary forward into the corps area, rendering pri-

marily general support on either an area or task assignment basis. Coordination is primarily at engineer brigade level.

3-9. Headquarters and Headquarters Company, Engineer Combat Group

This company provides the command and staff elements of the group and furnishes administrative, communications, and aviation support for combat and combat support operations. The group headquarters and headquarters company is organized under TOE 5-52 and consists of the following elements (fig. 3-1):

a. Group Headquarters. Headquarters consists of the command and major staff members. The group commander is assisted by the following staff: Executive officer, adjutant (S1), intelligence officer (S2), operations officer (S3), supply officer (S4), chaplain, aviation officer, communications officer, engineer equipment officer, surgeon, liaison officer, and sergeant major. The staff is guided by the desires of the commander and as generally outlined in FM 101-5, FM 5-1, and AR 611-101. Informa-

tion pertinent to the duties of enlisted members of the various staff sections is discussed in AR 611-201.

b. Company Headquarters. The responsibilities are similar in nature to the company headquarters, engineer brigade (para. 2-10b).

c. Administrative Section. This section, under the supervision of the group adjutant (S1), processes personnel management and related actions, maintains records of assigned personnel, and provides administrative and classification services. Additionally, the administrative section operates the headquarters message center; supervises and inspects the administrative activities of subordinate units; and assists and advises the group commander and subordinate units in administrative matters.

d. Intelligence Section. This section, under the supervision of the intelligence officer, collects, evaluates, processes, and disseminates intelligence information with emphasis on engineer aspects; conducts and coordinates reconnaissance activities within the group; performs terrain analysis; photographs engineer proj-

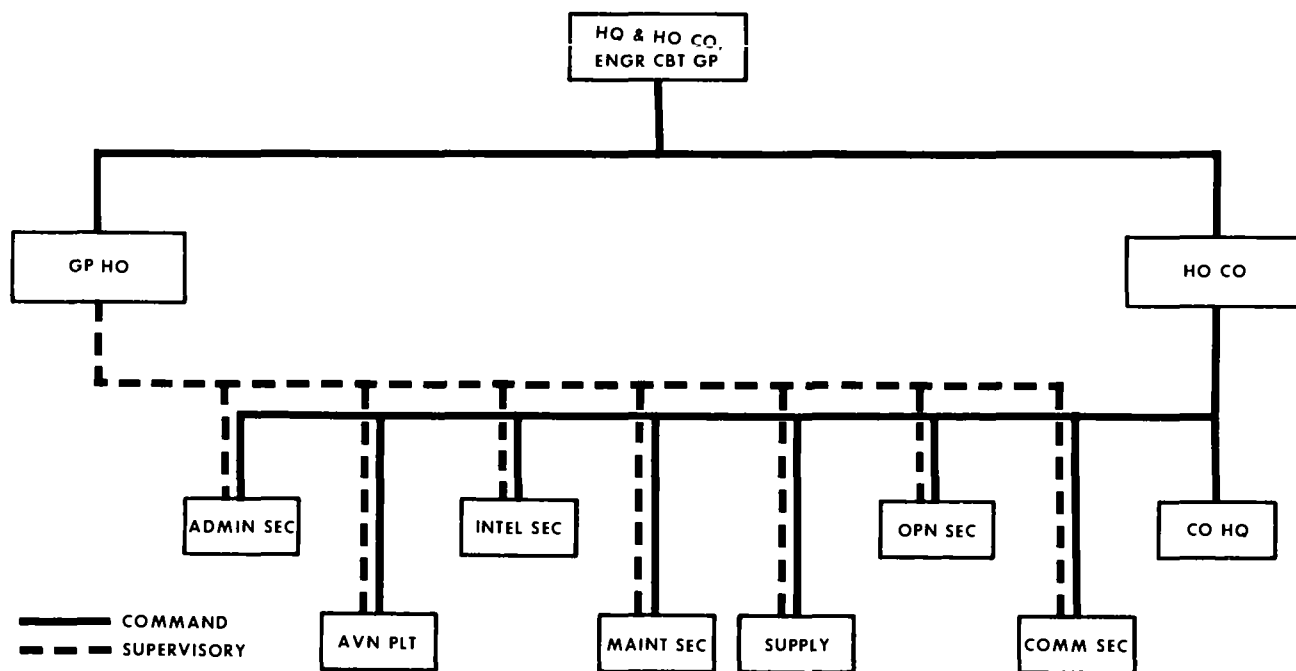


Figure 3-1. Organizational chart, headquarters and headquarters company, engineer combat group.

TO ENGR CBT BN & SEPARATE COMPANIES

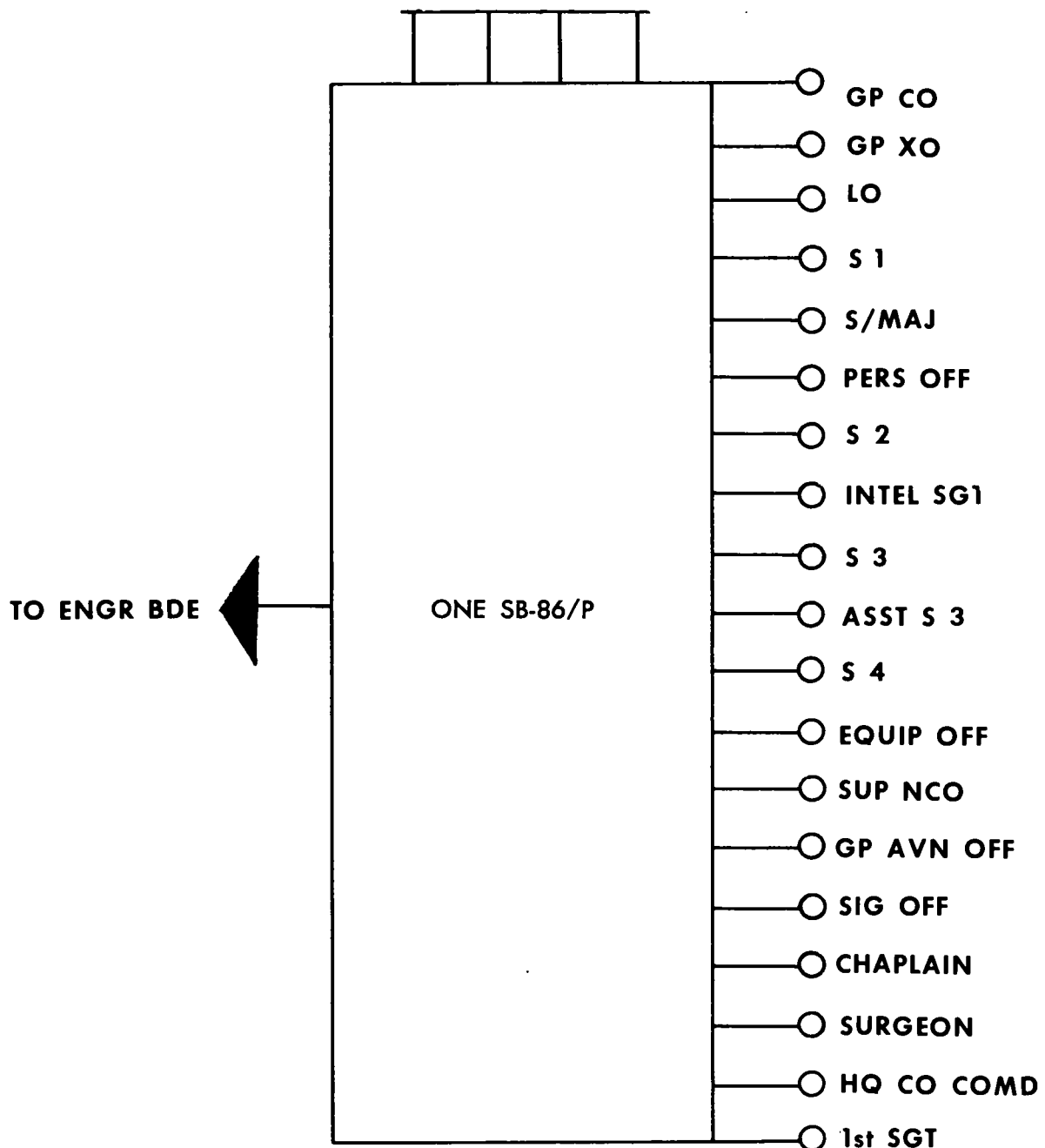


Figure 3-2. Typical wire diagram, engineer combat group.

ects; and assists and advises the group commander and subordinate units on matters relating to intelligence and counterintelligence.

e. Operations Section. This section performs duties similar to those of the operations sec-

tion, engineer brigade with the exception that close coordination with the engineer section at army or corps is not normally maintained (para. 2-10e).

f. Supply Section. Under the supervision of

the supply officer (S4), this section plans and coordinates requirements for and procurement of supplies, equipment, and construction materials; assists and advises the group commander and subordinate units on matters pertaining to supply; and advises the commander and subordinate units on food service matters. The group supply section, however, is not normally considered part of the supply channel for subordinate units.

g. Maintenance Section. This section, under the supervision of the engineer equipment officer, assists the commander in accomplishing his maintenance responsibilities as outlined in AR 750-8 by supervising and inspecting the maintenance of equipment within the group and assisting subordinate units in overcoming problems of maintenance and repair.

h. Communications Section. This section, under the supervision of the communications officer, plans and coordinates communication

activities within the group; operates the headquarters communication facilities; provides wire communications, normally through the area communications system, to subordinate units (fig. 3-2); controls the group radio net (fig. 3-3); assists and advises the group commander and subordinate units on matters pertaining to communications; and provides organizational maintenance for organic signal equipment.

i. Aviation Platoon. This platoon, under the supervision of the aviation officer, operates aircraft in support of the combat engineering activities of the group. Aircraft are available, upon request, for use by units within the group to provide: assistance for command, control, liaison, communications, administration, supply, air transportation for ADM teams, ADM and related equipment, aerial reconnaissance, and a limited capability to lift small engineer work parties.

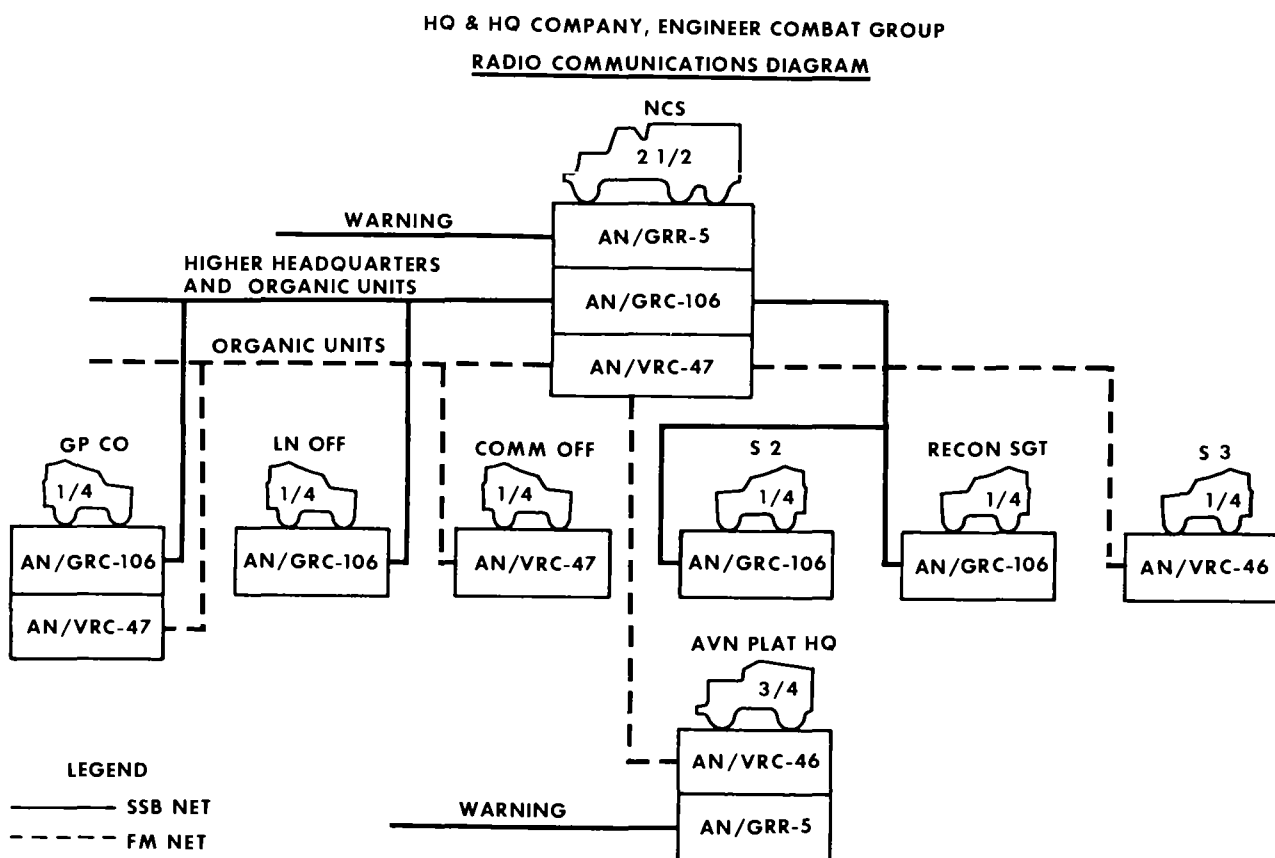


Figure 3-3. Typical radio net, engineer combat group.

CHAPTER 4

ENGINEER COMBAT BATTALION, ARMY

Section I. CHARACTERISTICS

4-1. Organization

The engineer combat battalion (army) is organized under TOE 5-35 and consists of a headquarters and headquarters company and four engineer combat companies (fig. 4-1). The engineer combat battalion (army) is the major nondivisional combat engineer unit attached to a combat engineer group. The term, engineer combat battalion, as used in this manual refers to the nondivisional engineer combat battalion (army). References to divisional engineer combat battalions, as discussed in FM 5-135 and FM 5-136 will fully identify those units.

4-2. Mission

The mission of the engineer combat battalion (army) is to increase the combat effectiveness

of the force to which attached by means of engineer combat support and general engineer work and to reinforce divisional engineers as needed. The engineer combat battalion (army) may also perform ground combat in an infantry role when required.

4-3. Major Items of Equipment

The major items of equipment of the engineer combat battalion are listed in the TOE of the organic companies.

4-4. Mobility

This unit is fully mobile and 100 percent air transportable in phase III airlift operations.

4-5. Assignment

a. The engineer combat battalion is assigned

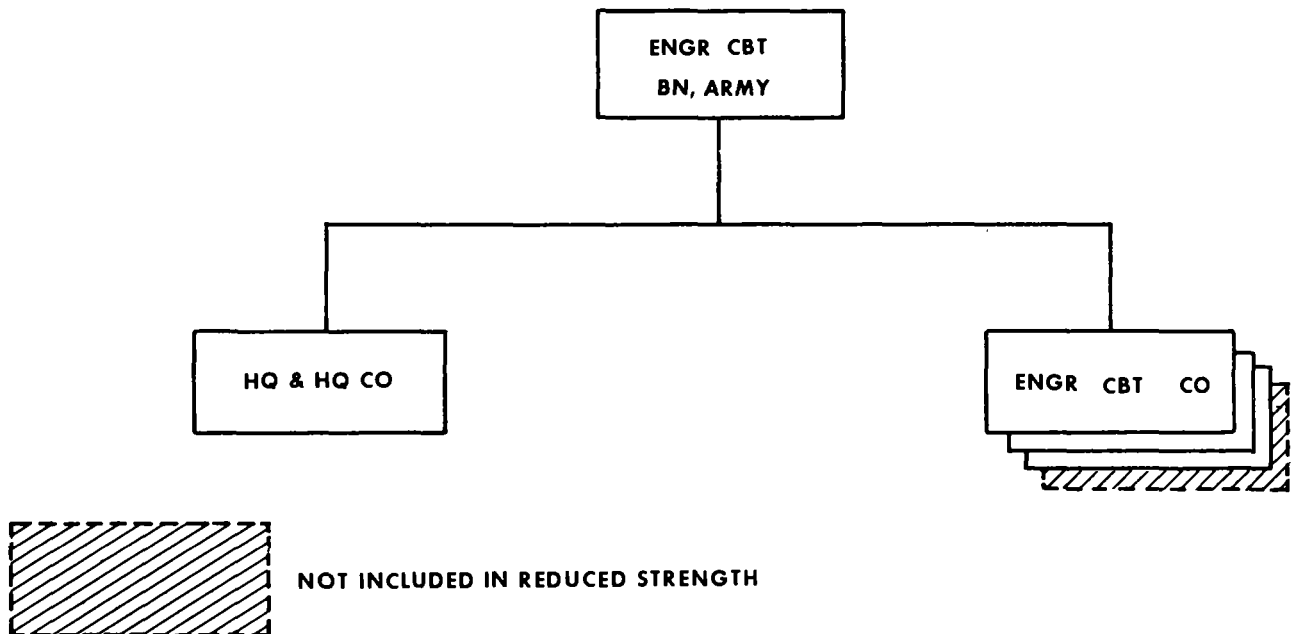


Figure 4-1. Organizational chart, engineer combat battalion (army).

to army or independent corps and further attached to an engineer combat group.

b. The battalion is similar in organization to the ROAD division engineer battalions and may be used to replace a divisional battalion. When so used, it should be provided with combat engineer vehicles, armored personnel carriers, if required, a bridge company, and an ADM capability.

4-6. Capabilities

The engineer combat battalion (army) is capable of providing—

a. Construction, repair, and maintenance of roads, fords, bridges, culverts, air-landing facilities, pipeline facilities and tank farms (when supported by a pipeline construction support company), command posts, supply installations, shelters, buildings, structures and related facilities.

b. Planning, preparing sites, and supervising attached or supporting ADM teams (TOE 5-500) in the firing of atomic demolitions munitions.

c. Preparation and removal of obstacles to include minefields.

d. Installation and operation of field potable water point facilities.

e. Construction and placement of deceptive devices and technical assistance in camouflage operations.

f. Site preparation for air defense artillery units.

g. Construction of defensive installations.

h. Engineer support in river-crossing operations to include assault crossing of troops and responsibility for the installation of tactical rafts and bridges.

i. Engineer support in the assault of fortified positions.

j. Engineer support in amphibious operations as part of the shore party.

k. An infantry force when reorganized for ground combat.

4-7. Employment

The success of military engineering operations in the field army depends to a large extent upon the ability of the army engineer to

move his units anywhere in the army area to support these operations. Although units are referred to as corps, army, or division engineer troops, these terms are used mainly to identify the higher headquarters to which the unit is assigned or attached and is not a limitation on the area in which a unit will work, although corps engineer effort will normally be reinforced by the army engineer brigade rather than laterally from adjacent corps. It is not unusual to have an engineer battalion assigned to army, working in the division area. Frequently, an engineer battalion attached to a corps will be working on a large job and, because of a change in boundary, will find itself in the field army service area. In addition to working forward or to the rear of their normal areas, units frequently work in adjacent corps areas with no change in assignment orders. The fact that a unit is assigned to I Corps does not preclude its working in the area of II Corps should the situation arise where II Corps needs additional engineer help. This applies especially to the support-type units such as bridge companies, dump truck companies, or light equipment companies.

a. Task or Area Assignments.

(1) The group commander normally assigns an engineer combat battalion to an area with responsibility for all engineer operations within that area. Assignment of tasks to subordinate units is directed by the battalion commander.

(2) When the situation warrants, a combat battalion may be assigned specific tasks instead of an area-type mission.

(3) The construction capabilities of the battalion may be augmented by the attachment of engineer equipment from the light equipment company and of trucks from the engineer dump truck company. Servicing and organizational maintenance is the responsibility of the supported unit.

(4) In a tactical bridging mission, the appropriate engineer bridge unit of the group delivers the bridge to the site and provides technical advice and assistance and additional erection

equipment to the engineer combat battalion installing the bridge.

b. Corps Area. Normally, each committed division of the corps is supported by one of the combat engineer groups of the corps engineer brigade. The amount and type of support varies in accordance with the operational environment. In some cases the combat group may provide only general support. In other cases, the entire group may be placed in direct support of a particular division. The usual assignment is, however, one engineer combat battalion in direct support of a division with the remainder of the group in a general support role. The direct support battalion accepts engineer tasks requested by the division. If the battalion does not possess the capability to accomplish the mission, the battalion commander requests additional means from the engineer group (ch. 9).

c. Army Area.

- (1) Area assignments are generally given to engineer combat battalions. On the other hand, construction and other special engineer units, whose usual location is within the communication zone, operate in the army area primarily on task assignments.
- (2) In general, army engineer units support each corps by performing engineer tasks within the corps area up to the forward line of army maintenance. Specific tasks designated by the army engineer may be accomplished forward of the maintenance line. This division of work, including the location of the forward line of army maintenance, is agreed upon informally between the corps engineers and the army engineer.

Section II. HEADQUARTERS AND HEADQUARTERS COMPANY, ENGINEER COMBAT BATTALION (ARMY)

4-8. Mission and Capabilities

Headquarters and headquarters company, engineer combat battalion (army), provides command, staff, administrative, communications, reconnaissance, supply, supplemental heavy equipment, and medical services for the battalion. This unit is capable of—

- a.* Providing command, control, staff planning, and supervision of battalion operations.
- b.* Performing engineer reconnaissance and intelligence functions.
- c.* Preparing plans for the employment of atomic demolitions munitions.
- d.* Providing a maximum of five potable water points.
- e.* Providing organizational maintenance support for battalion and attached units.
- f.* Providing supplemental engineer equipment to support the combat construction effort of the battalion.
- g.* Providing unit level medical service to include emergency medical treatment, evacuation of casualties, operation of the battalion aid station, and supervision of sanitation.

h. Operating the battalion communications system.

i. Providing local security for the battalion headquarters.

4-9. Battalion Headquarters

The battalion headquarters consists of the command and major staff officers (fig. 4-2). The battalion commander assigns the companies specific tasks or responsibilities for special or general engineer work as determined by his estimate of the situation. Necessary augmentation of the engineer combat companies with equipment, operators, and maintenance personnel from the battalion headquarters company and separate units is accomplished when required. The battalion commander is assisted in carrying out his command responsibilities by the following staff: executive officer, adjutant (S1), intelligence officer (S2), operations officer (S3), supply officer (S4), communications officer, surgeon, chaplain, engineer equipment officer, and sergeant major. Staff officers are guided by the desires of the commander and as outlined in FM 101-5, FM 5-1, and AR 611-101. Information pertinent to the duties of enlisted members of the various staff sections is discussed in AR 611-201.

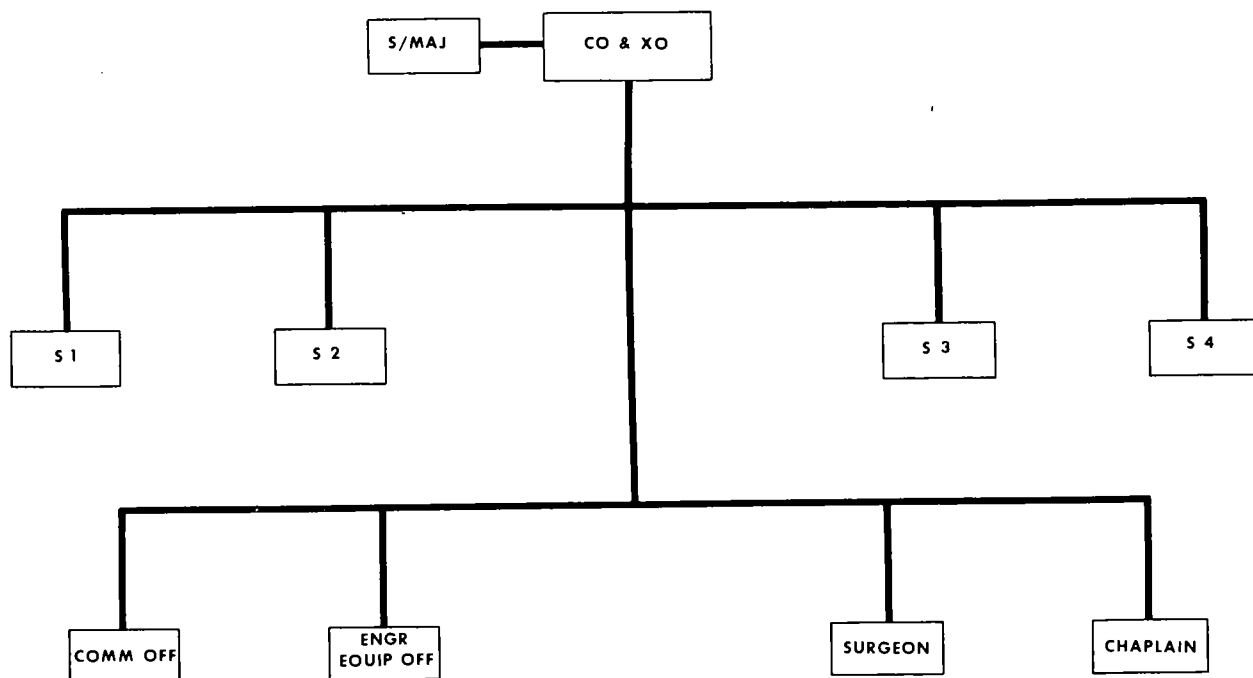


Figure 4-2. Organizational chart, headquarters, engineer combat battalion (army).

4-10. Headquarters Company

Headquarters company is organized under TOE 5-36 and consists of the following sections (fig. 4-3):

a. Company Headquarters. The responsibilities are similar to those outlined in paragraph 2-10b for the company headquarters, engineer brigade, except that maintenance is performed by the battalion maintenance section.

b. Administrative Section. This section, under the supervision of the adjutant (S1), provides the necessary personnel and facilities to perform the consolidated personnel and administrative functions of the battalion.

c. Intelligence Section. This section performs in a manner similar to the intelligence section, engineer combat group (para. 3-9d).

d. Operations Section. This section provides the necessary personnel and facilities to assist the operations officer in formulating the operations plans for accomplishing the assigned missions and training programs of the battalion. A chemical operations sergeant is included as part of the operations section to provide advice and assistance concerning operations under CBR conditions.

e. Supply Section. This section, under the supervision of the supply officer, provides personnel and equipment to accomplish the supply functions of the battalion including ration breakdown. Personnel and equipment are also provided to operate a maximum of five potable water points.

f. Communications Section. This section, under the supervision of the communications officer, provides the necessary personnel and facilities for the operation of the battalion radio net (fig. 4-4) and telephone communications (fig. 4-5).

g. Maintenance Section. The maintenance section performs organizational maintenance for headquarters and headquarters company and assists subordinate units in the performance of organizational maintenance for vehicles and engineer equipment. Direct and general support maintenance (AR 750-1) is performed by appropriate supporting maintenance units. The section assists and advises the battalion and unit commanders on the technical aspects of the operation and maintenance of equipment. Repair parts for organic and attached units of the battalion are controlled by this section.

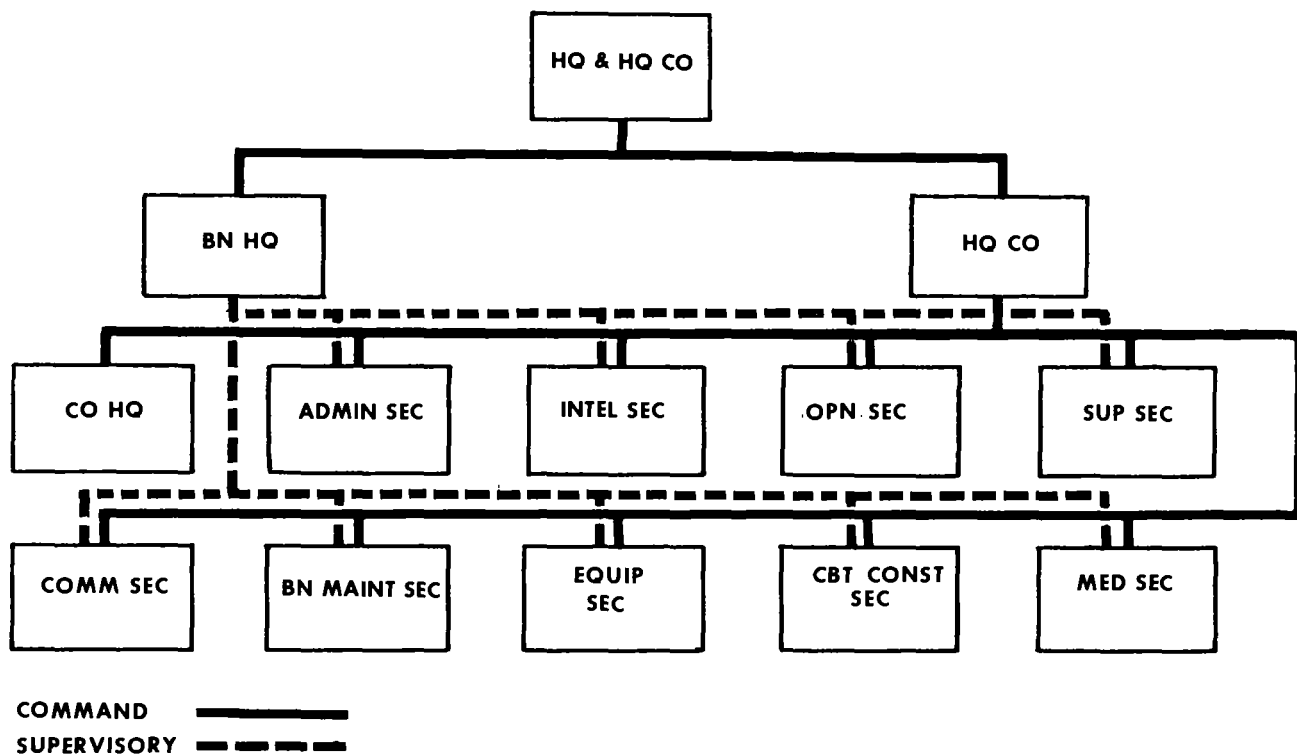


Figure 4-3. Organizational chart, headquarters and headquarters company, engineer combat battalion, army.

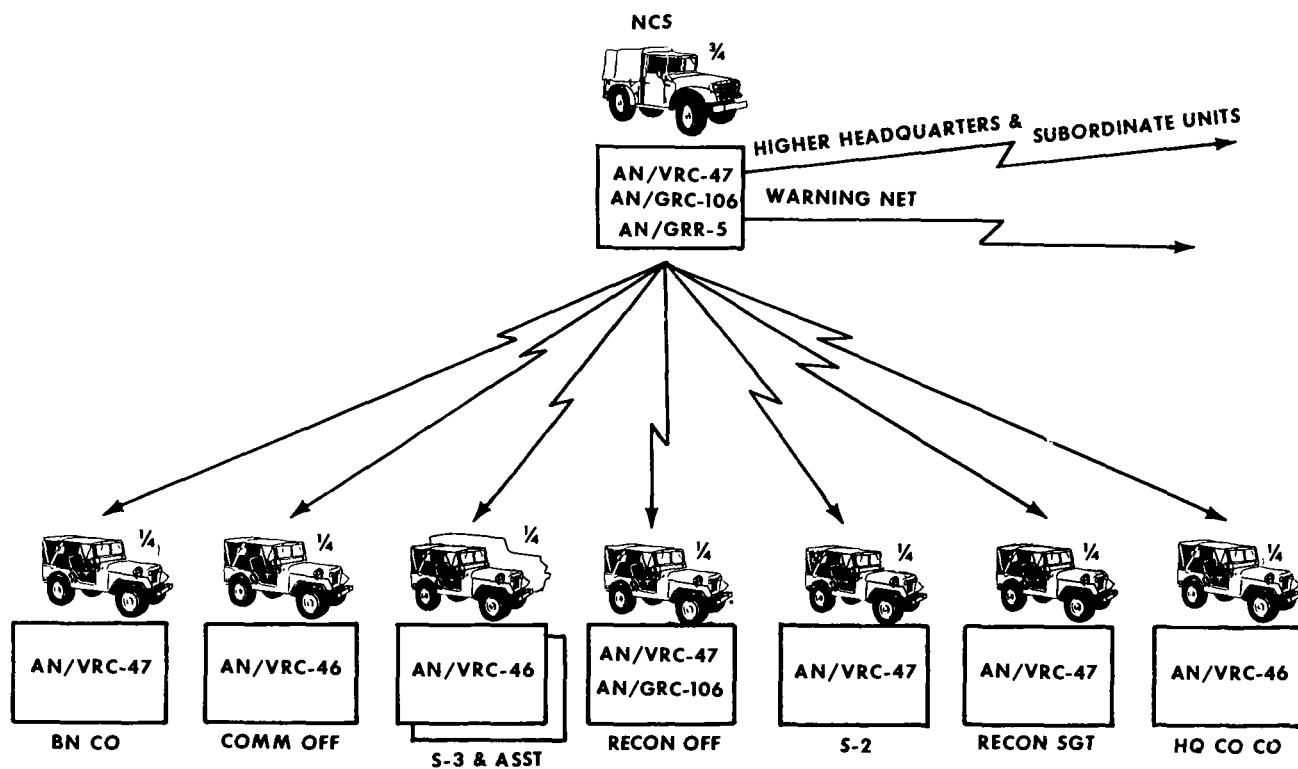


Figure 4-4. Radio net, engineer combat battalion, army.

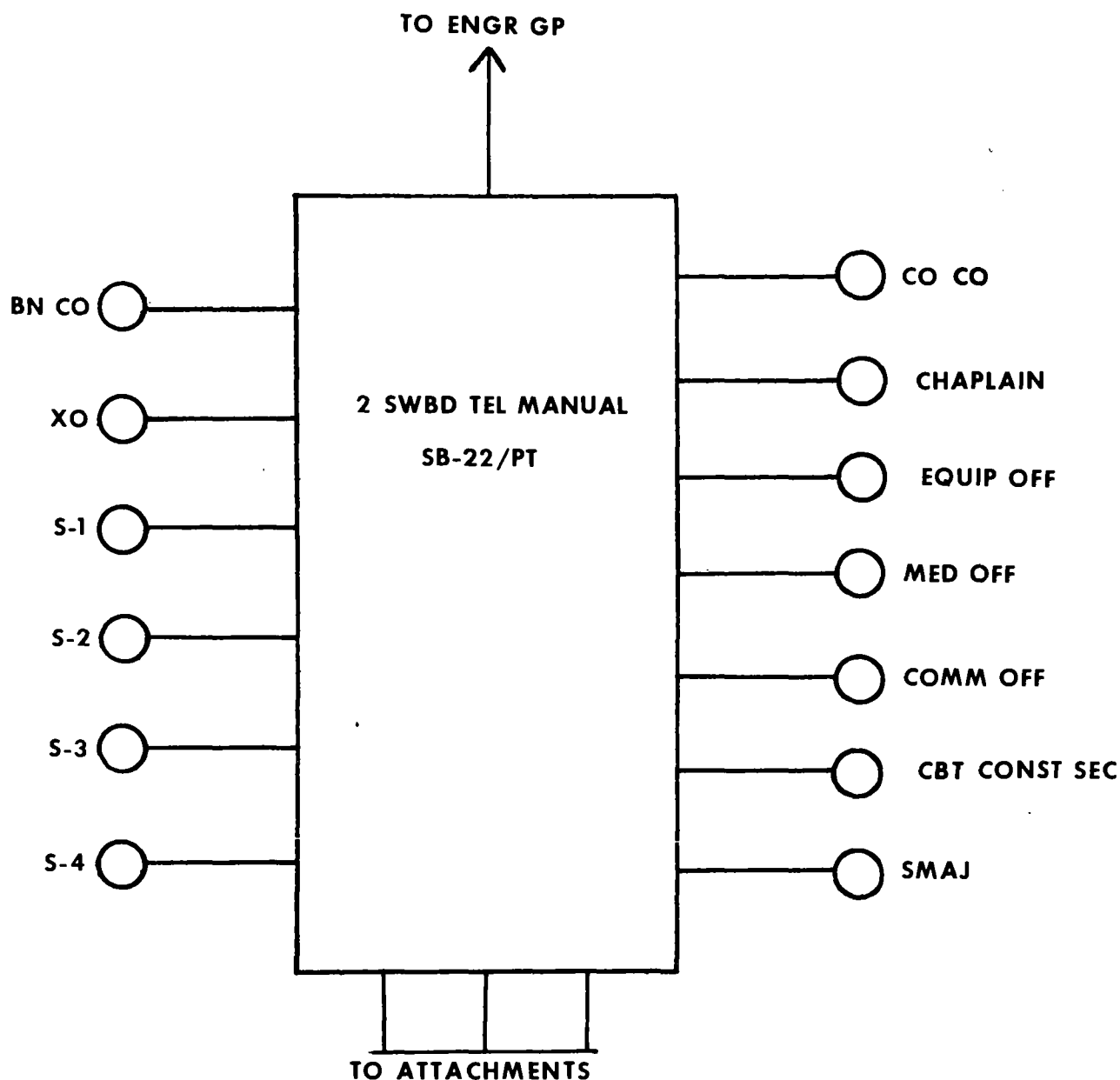


Figure 4-5. Wire diagram, engineer combat battalion, army.

h. Equipment Section. This section provides operating personnel and supplemental engineer equipment to increase the combat construction capability of the battalion. Operators, with equipment such as crane shovels, motorized road graders, concrete mixer (see TOE 5-36 for complete listing), are dispatched to the engineer combat companies from this section as directed by the engineer equipment officer in coordination with the operations officer. The

battalion maintenance officer, by frequent inspection, insures that all equipment attached to other organizations receives proper maintenance; the maintenance section will be prepared to provide assistance when necessary.

i. Combat Construction Section. The combat construction section provides a pool of specialized personnel with construction skills not found in the lettered companies. These specialists include electricians, carpenters, plumb-

ers, sheet metal worker, mason, heating and ventilating specialist, and a utilities foreman. The combat construction section is included in the nondivisional engineer battalion TOE for four main purposes. They are—

- (1) To provide skilled personnel to an engineer squad or platoon to assist them in minor construction projects. In the past when a combat company had a project that required the skills of a plumber, electrician, mason, or sheet metal worker, it was necessary to review the secondary skills of all assigned personnel to determine whether any could do the job. When a man with the proper skills was located, he did not have the proper tools to do the job. Further, it meant depleting a squad or platoon of one or more of its men. Now the company commander can make his requirements known to the S3 who will furnish the men and tools required to do the job.
- (2) To provide skilled technicians to hospitals, depots, or headquarters elements to do minor repair and utilities work. Engineer battalions are frequently called in by higher headquarters to provide this support. Personnel from the combat construction sec-

tion furnish the necessary men without depleting the squads of the companies.

- (3) To supervise projects. Frequently, battalions must supervise large numbers of indigenous workers who are doing construction projects in the area. In the past they often lacked the skilled supervisors to supervise or inspect the work being done. Now the combat construction section provides the skilled personnel needed to provide this technical supervision.
- (4) To accomplish small jobs. This section, under the supervision of the section leader, may accomplish minor engineer combat construction tasks when the size or complexity of the tasks does not warrant assignment to an engineer combat company.

j. Medical Section. The medical section, under the supervision of the battalion surgeon, provides the necessary personnel and equipment for the operation of the battalion medical facilities to include the aid station, evacuation of the sick and wounded, and medical support for the engineer combat companies by the attachment of aidmen as needed. The section maintains the medical records of all assigned personnel.

Section III. ENGINEER COMBAT COMPANY, ENGINEER COMBAT BATTALION, (ARMY)

4-11. General

The engineer combat company is a major organic component of the engineer combat battalion (army). The company is organized into a company headquarters and three engineer platoons (fig. 4-6).

4-12. Capabilities

At full strength the engineer combat company is capable of—

a. Preparing sites and assisting ADM teams in the execution of atomic demolition munitions missions.

b. Construction, repair and maintenance of roads, fords, bridges, culverts, aircraft land-

ing facilities, command posts, and supply installations.

c. Preparing and removing obstacles to include minefields.

d. Construction and placement of deceptive devices.

e. Site preparation for air defense artillery units.

f. Construction of defensive installations.

g. Engineer support in river-crossing operations including aid to amphibians, assault crossing of troops, and construction of tactical rafts and bridges when supported by engineer bridge units.

h. Construction of POL pipelines when sup-

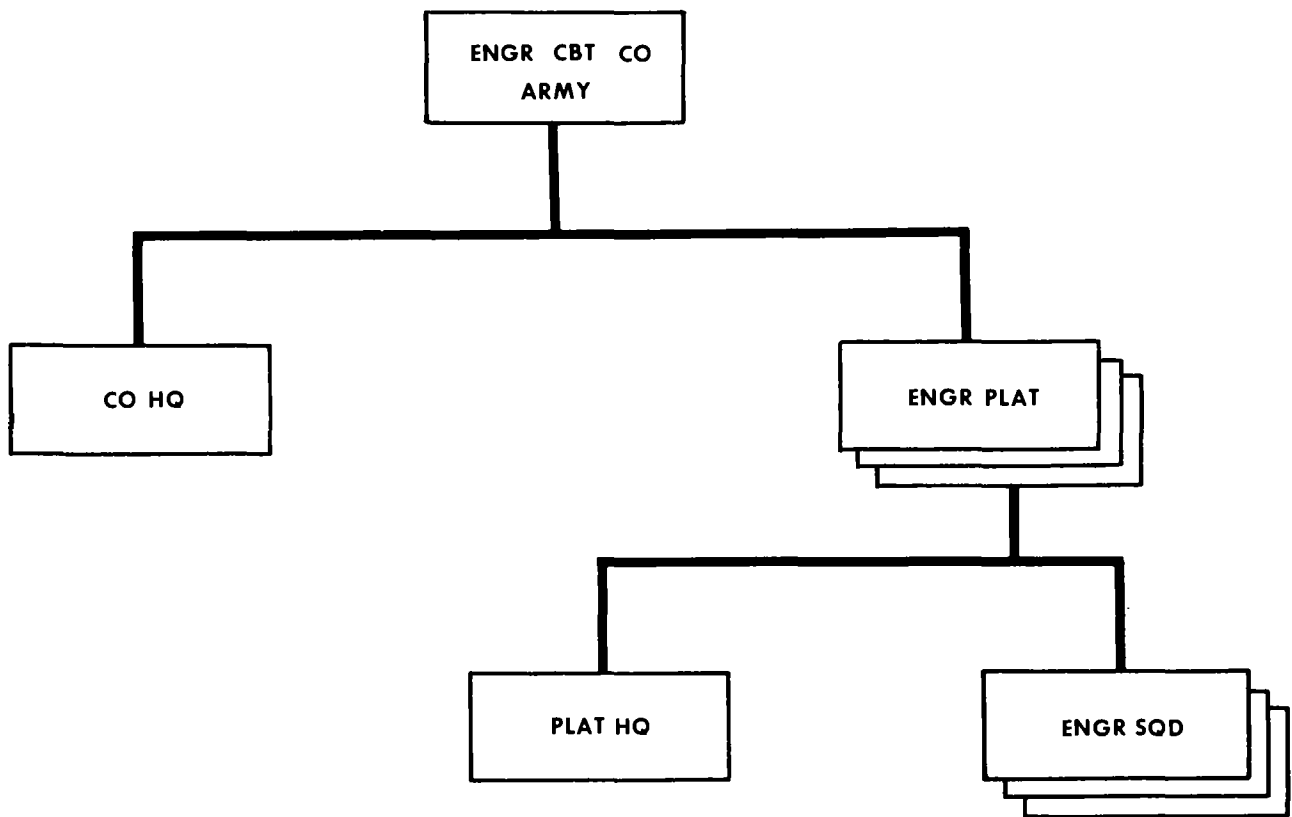


Figure 4-6. Organizational chart, engineer combat company, engineer combat battalion, army.

ported by a pipeline construction support company.

i. Performance of ground combat in an infantry role.

4-13. Employment

a. Normally, the engineer combat company is assigned either specific tasks or areas of responsibility as determined by the tactical situation. The company can perform limited engineer missions with organic equipment; the company's effectiveness, however, is normally increased by the attachment of general or special engineer equipment from the battalion headquarters and headquarters company.

b. The company may be attached or placed in direct support of tactical units which do not have organic engineer units or it may reinforce divisional engineer units. This unit is similar in organization to the divisional engineer company and, therefore, may be used to replace a divisional unit when necessary.

4-14. Administration

Administration activities are centralized, for the most part, at battalion headquarters, relieving the company commander from as much administration as possible.

4-15. Organization

The engineer combat company is organized under TOE 5-37 and consists of the following elements:

a. *Company Headquarters.* The headquarters provides the necessary personnel and facilities by which the company commander exercises command, control, and coordination of the unit's activities. Mess, supply, and organizational maintenance personnel are included within the headquarters. Communications personnel and equipment provide communications with battalion headquarters, supported units, and organic platoons. See figures 4-7 and 4-8 for typical radio and wire communications diagrams.

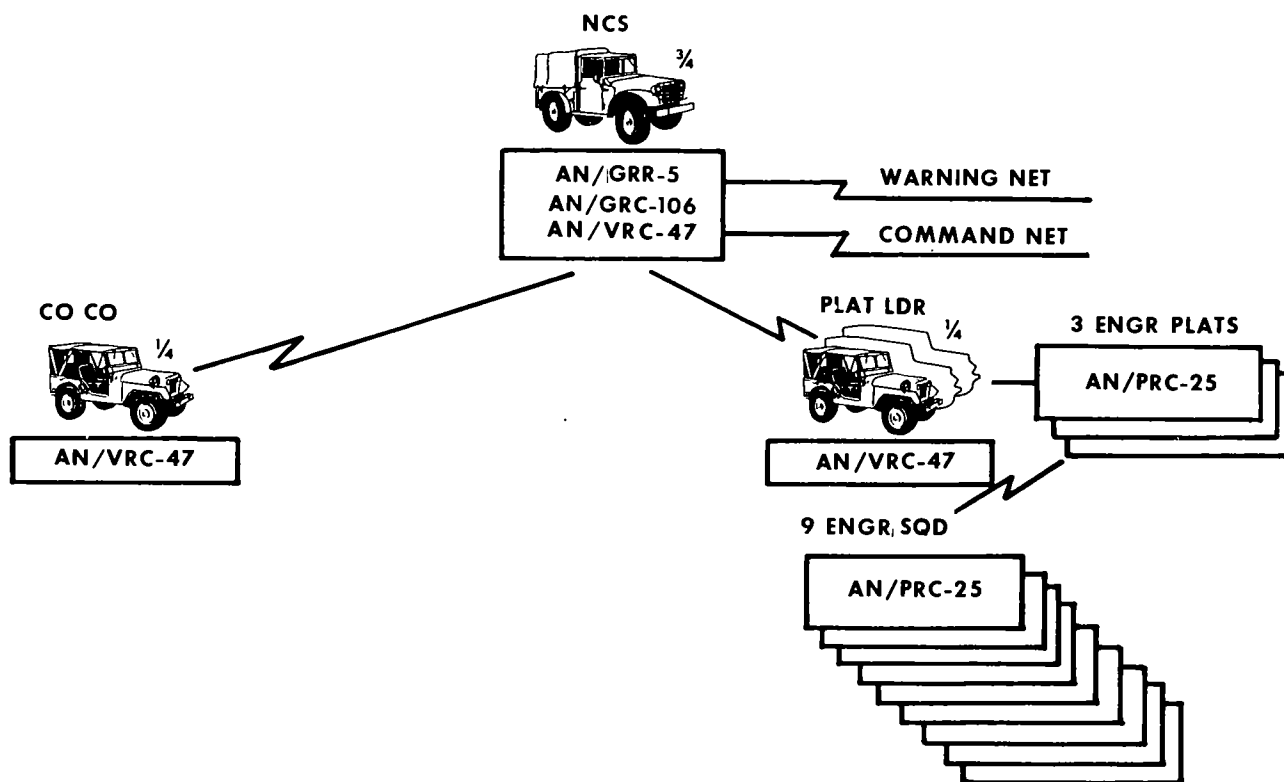


Figure 4-7. Typical radio net, engineer combat company, engineer combat battalion (army).

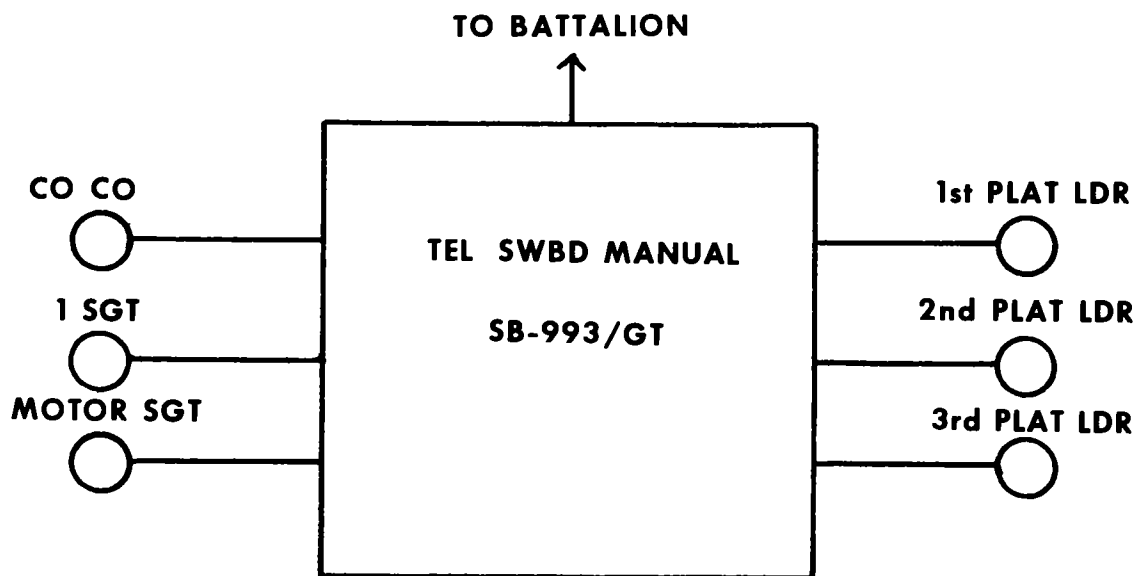


Figure 4-8. Typical wire diagram, engineer combat company, engineer combat battalion (army).

b. Engineer Platoon. Three engineer platoons constitute the operational elements of the company. Command and control of each platoon is furnished by a platoon headquarters. Signal equipment is authorized each platoon headquarters to maintain communication with the company headquarters and supported units, and to facilitate supervision and control.

c. Engineer Squads. Nine engineer squads are the basic work elements of the company. Each squad is equipped with tools, demolition equipment, and transportation. The three squads organic to each platoon are normally employed under platoon control and perform specific tasks of combat engineer support including demolition, pioneering, and combat missions.

CHAPTER 5

ENGINEER FLOAT BRIDGE COMPANY

Section I. CHARACTERISTICS AND EMPLOYMENT

5-1. General

The engineer float bridge company is a separate company which is normally assigned to a field army or separate corps and further attached to an engineer combat group. The float bridge company provides personnel and equipment to load, transport, and maintain tactical stream-crossing equipment. It also gives technical advice and assistance in the erection of its bridging. The company may be assigned a secondary role of general cargo hauling; however, this requires immobilizing its bridge equipment. The company is fully mobile and 100 percent air transportable (FM 101-10).

5-2. Capabilities

a. At full strength, the engineer float bridge company is capable of—

- (1) Providing approximately 216 meters of M4T6 floating bridge, or ten rafts, or a combination of bridge and rafts capable of carrying divisional loads (fig. 5-1).

Note: The Class 60 floating bridge in approximately the same quantities may be issued in lieu of M4T6 bridging.

- (2) Providing, in support of tactical operations, light stream-crossing equipment such as assault boats, a foot-bridge, and light tactical rafts.
- (3) Furnishing technical advice and assistance to other engineer units in floating bridge and raft erection.
- (4) Erecting bridges and rafts with organic personnel at a significantly reduced rate of speed.
- (5) Providing 5-ton and 2½-ton trucks for general cargo hauling by off-loading organic bridging.

- (6) Performing organizational maintenance on organic equipment.

- (7) Maintaining installed float bridges.

b. The engineer float bridge company has a limited capability of defending itself and installations against hostile ground attack.

5-3. Employment

a. Normally, bridging and other crossing equipment is installed by elements of an engineer combat battalion (army) in support of division or corps operations. The float bridge company transports the equipment to the crossing site, provides technical advice and assistance, and furnishes additional erection equipment and operators. When the river-crossing is a division operation, float bridge units may be attached to the division engineer combat battalion or to the engineer combat battalion (army) which is in direct support of the division. When the river-crossing is a corps operation, some of the engineer effort may be kept directly under corps control if early use of bridges and rafts by other major units is contemplated. Normally, the division commander executing an assault crossing is provided control of all necessary crossing means to assure the success of his operation (FM 31-60). When control is retained by corps, the engineer effort is directed by the engineer brigade headquarters (corps) through the engineer combat groups.

b. Additional bridging, when required, is transported by the company from the supply activity to the work site. Transport capability is provided by off-loading organic bridging either at the construction site or at a forward bridge park.

c. The company is trained to install its own bridge and rafts and may be called upon to do so when other engineer combat troops are not

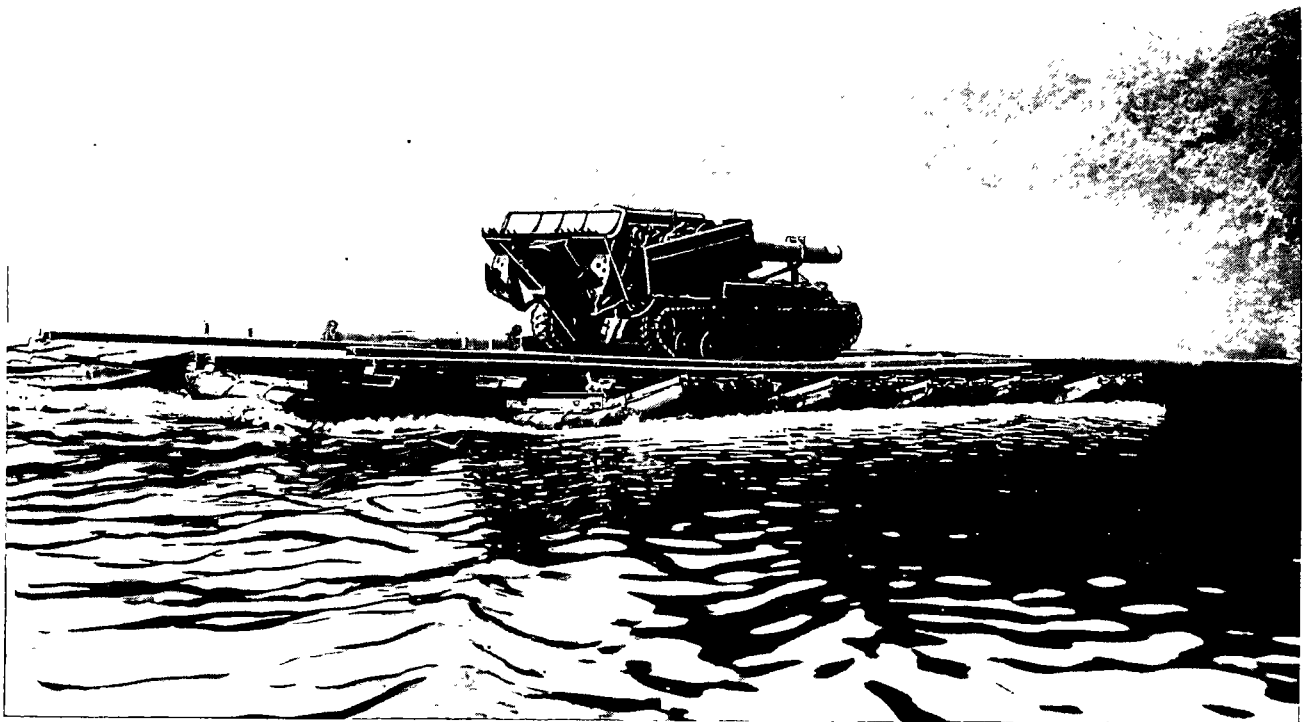


Figure 5-1. M4T6 five-float raft.

available. However, tactical operations usually require completion of bridges in less time than can be achieved by the limited manpower and erection equipment of the company alone.

d. The company may be required to maintain installed bridges and furnish bridge guards to help control traffic and prevent damage to the bridges.

e. The company also disassembles the bridge or rafts, makes necessary repairs, and transports the equipage to future crossing sites.

f. When the company is employed on a general cargo-hauling mission, consideration must be given to the resultant loss of bridging capability. Under ideal conditions and using two cranes, the bridging can be reloaded in approximately 24 hours.

g. Technical information concerning the erection of floating bridges is contained in TM 5-210, Military Floating Bridge Equipment.

Section II. COMPANY ORGANIZATION AND PROCEDURES

5-4. General

The engineer float bridge company is organized under TOE 5-78 and consists of a company headquarters, an equipment and maintenance platoon, a support platoon, and five float bridge platoons (fig. 5-2).

5-5. Company Headquarters

The company headquarters of the engineer

float bridge company provides command, administration, mess, supply, and communication support for the company. The headquarters includes the company commander, the first sergeant, bridge sergeant, mess steward, supply sergeant, and other enlisted personnel necessary to carry out the company's functions. The company headquarters is normally employed intact to accomplish its support mis-

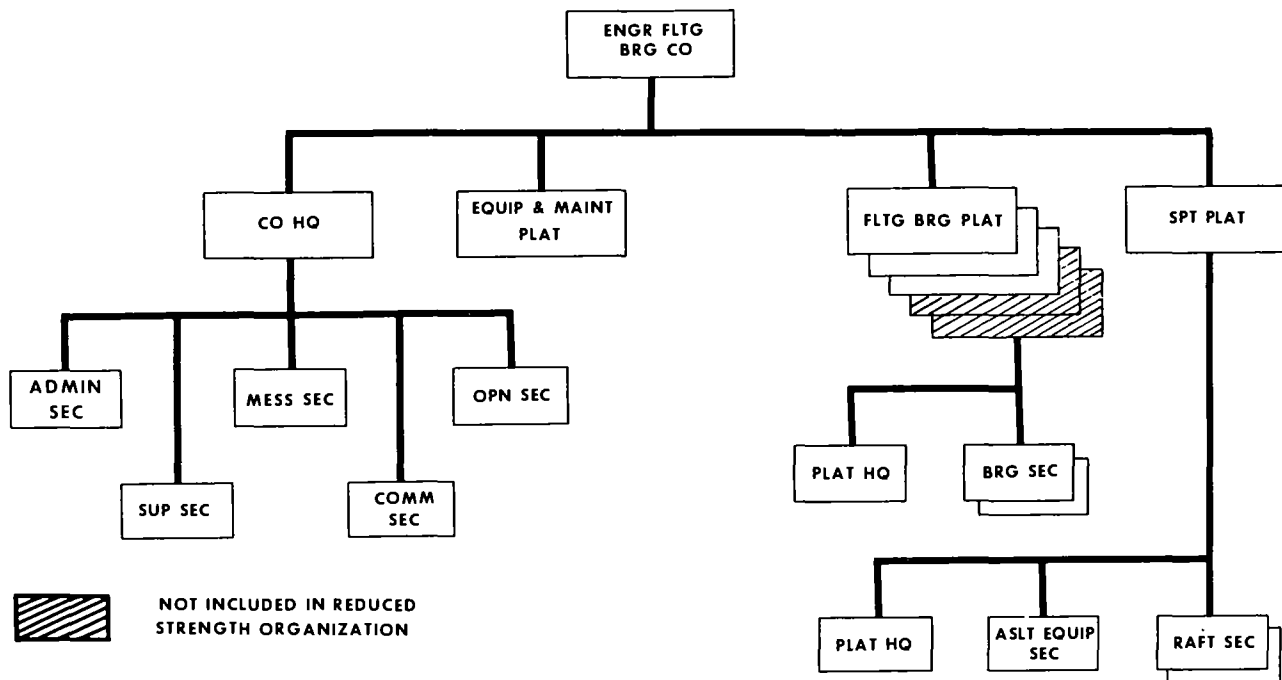


Figure 5-2. Organizational chart, engineer float bridge company.

sion. However, it is possible for elements of the headquarters to support independent platoon operations for a short period of time over a widely dispersed area.

5-6. Equipment and Maintenance Platoon

The equipment and maintenance platoon provides heavy equipment and operators in support of the company bridge platoons. The platoon also performs organizational maintenance and repairs within its repair parts authorization. The platoon is normally employed as a unit; repairs, whenever possible, are accomplished at the worksite. Elements of the platoon may occasionally be attached to the bridge platoons for assistance in the erection of bridges and rafts. The equipment and maintenance platoon—

a. Performs, directs, and supervises organizational maintenance, repair, and inspection of the company's vehicles and equipment.

b. Provides technical assistance for the bridge platoons in the employment of organic equipment.

c. Provides heavy equipment to assist in bridge erection.

d. Trains subordinate elements in the operation and organizational maintenance of engineer equipment.

5-7. Float Bridge Platoon

The float bridge platoon is the basic operational unit of the engineer float bridge company. The platoon is organized into a platoon headquarters and two bridge sections. Normally, the company is employed as a unit. However, the platoon may be detached from the company for independent operations. The float bridge platoon is capable of—

a. Loading, transporting, and maintaining one set of float bridge which provides a bridge approximately 46 meters in length or two rafts capable of carrying divisional loads (fig. 5-3).

b. Providing technical advice and assistance to engineer units in the erection of float bridges or rafts.

5-8. Support Platoon

The support platoon provides light, stream-crossing equipment for the assault phase of tactical river-crossing operations. The platoon consists of a platoon headquarters, two raft sections, and an assault equipment section. The support platoon is capable of—

a. Providing approximately 142 meters of aluminum footbridge (fig. 5-4).

b. Providing six light tactical rafts which



Figure 5-3. Class 60 floating bridge.

may be converted into a floating bridge (fig. 5-5).

c. Rendering technical advice and assistance to engineer units responsible for the erection of the footbridge and light tactical rafts.

d. Supplying 70 assault boats (inflation type, 15-man) for a tactical river-crossing operation.

5-9. Administration and Supply

The company, working closely with the group administrative section, prepares its own reports and files. When the company is located near the group headquarters, personnel records and files may be located and maintained at group headquarters by the company personnel

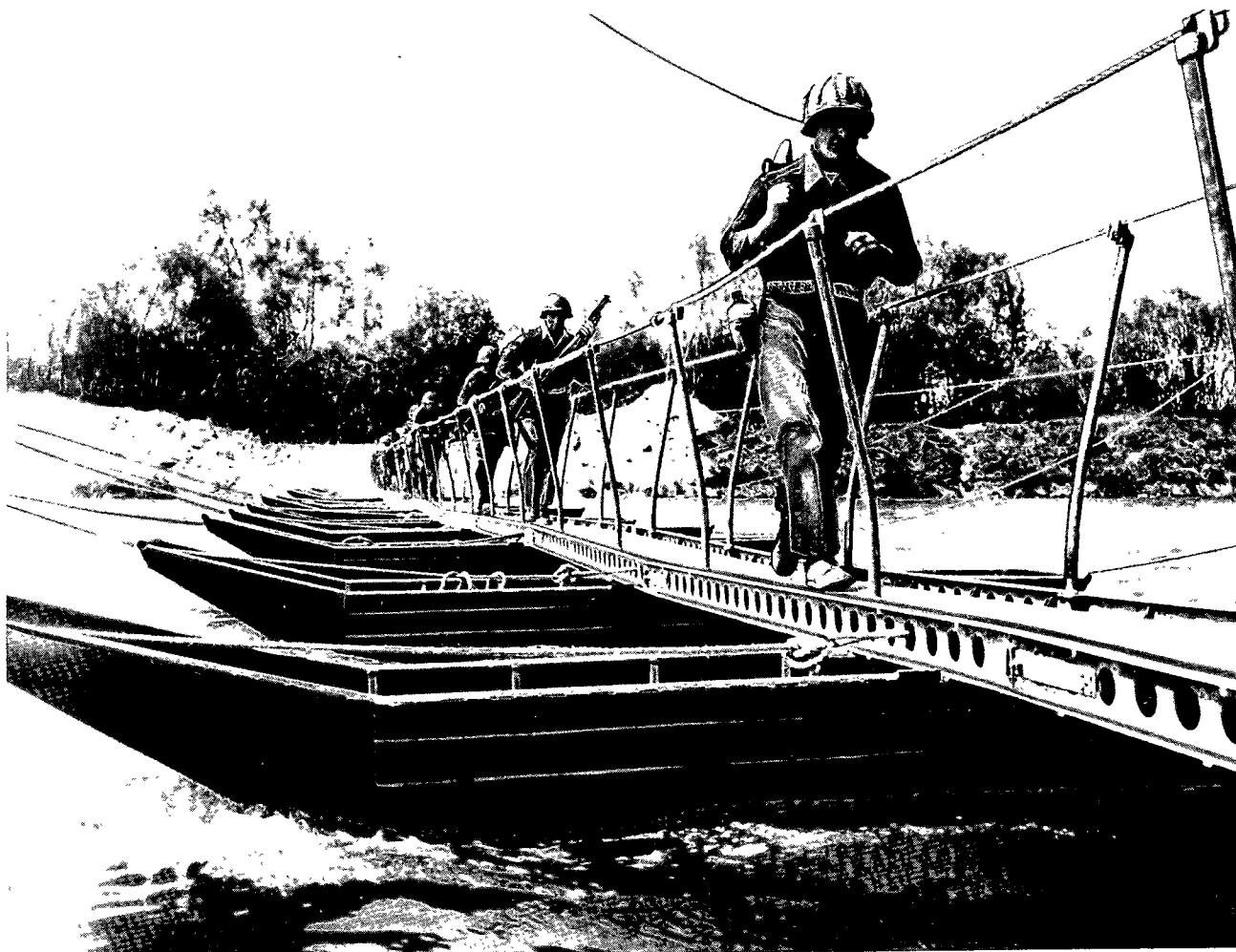


Figure 5-4. Infantry troops crossing a footbridge.

clerk working under the supervision of the group adjutant. The company requisitions, stores, and issues its authorized supplies, equip-

ment, and repair parts. Separate supply accounts are maintained with supporting supply activities.

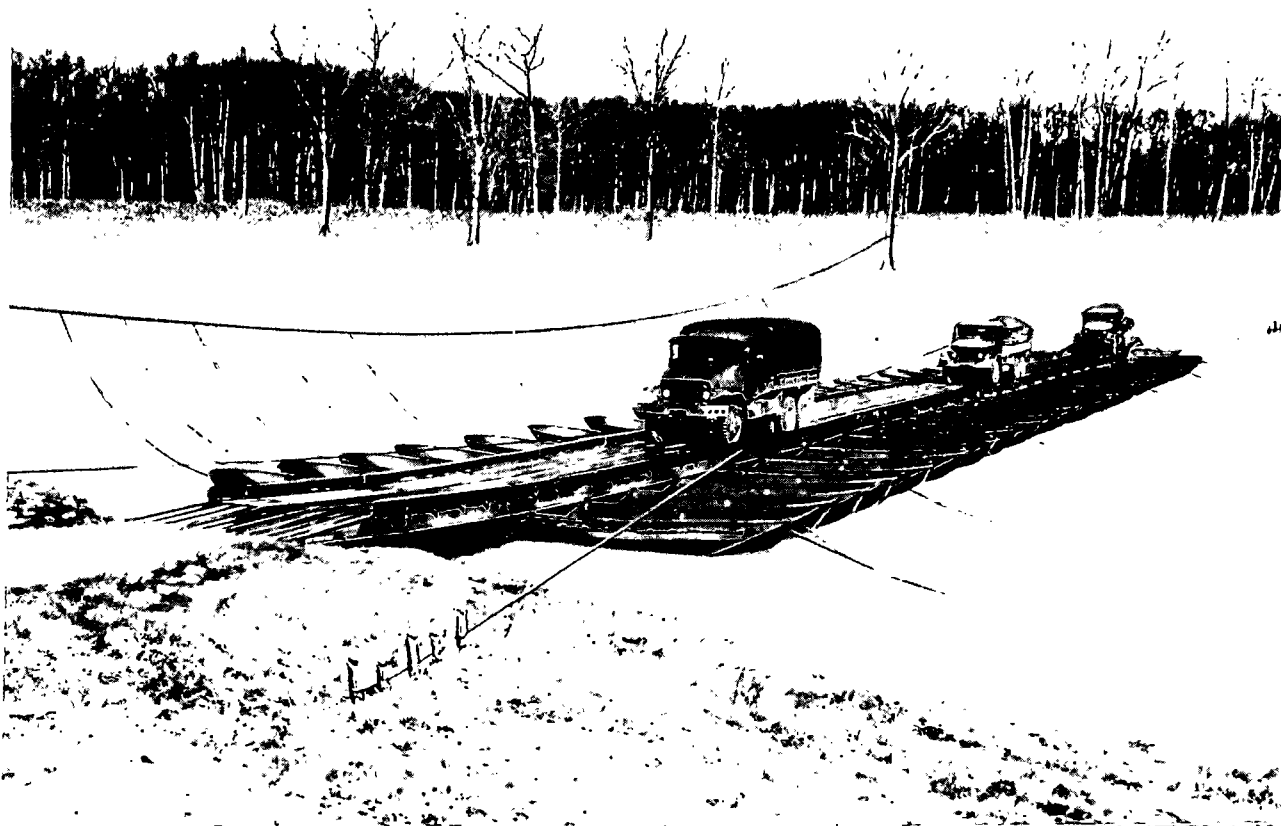
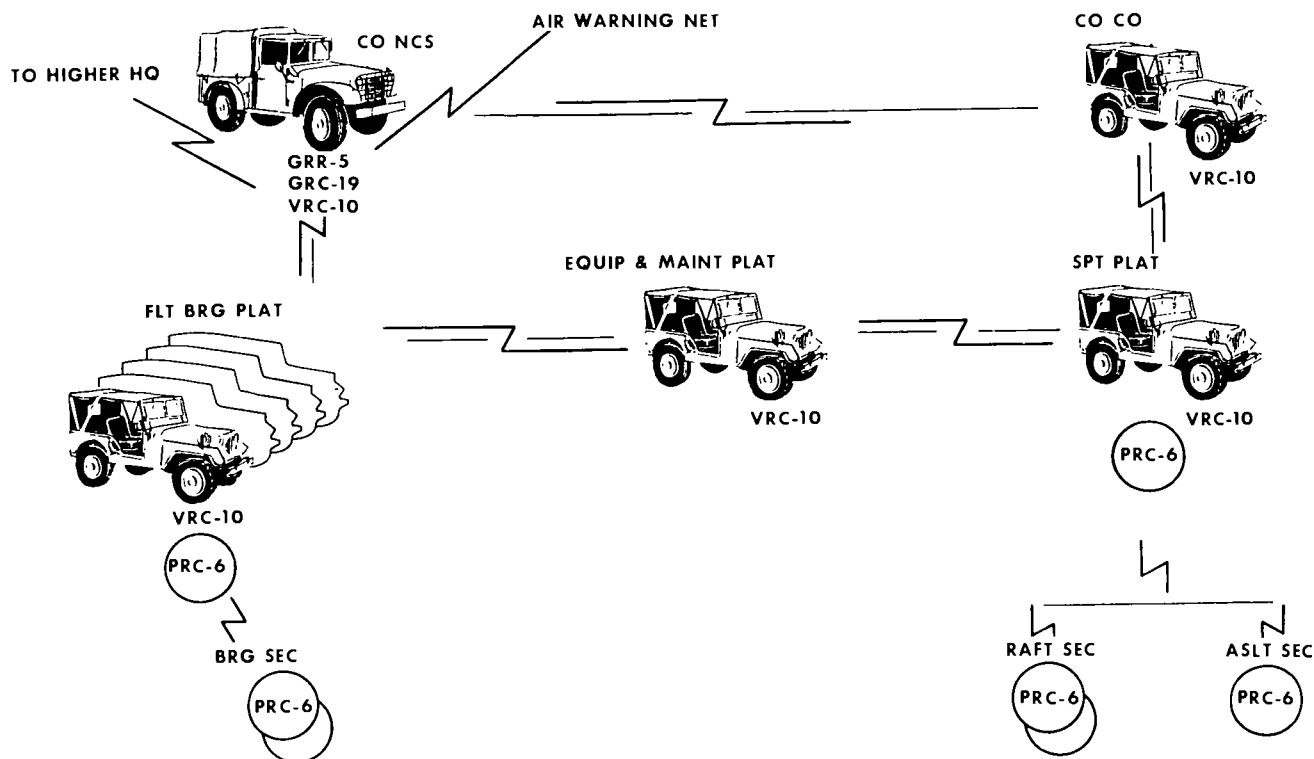


Figure 5-5. Bridge, floating: raft, light tactical.

5-10. Maintenance

The engineer float bridge company is responsible for organizational maintenance of all organic equipment including bridging. The

degree of maintenance performed is limited by the repair parts authorization and subject to the provisions of AR 750-1.



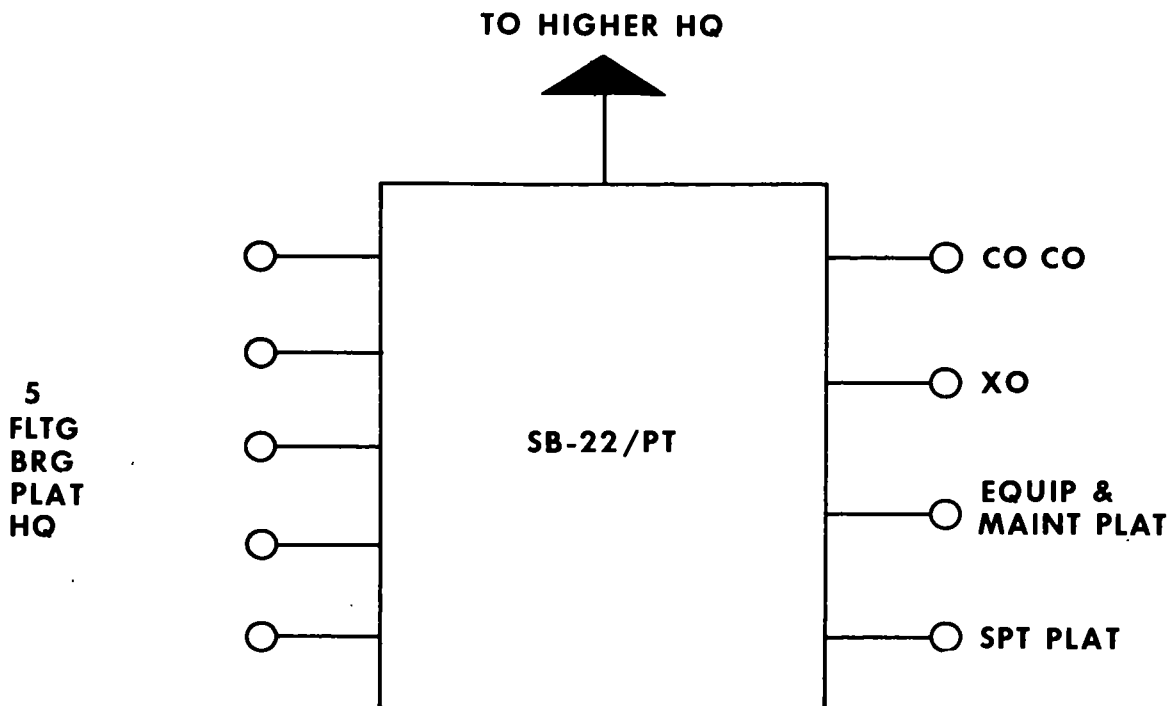
(NOTE: RADIOS CURRENTLY AUTHORIZED WILL BE REPLACED BY THE NEW FAMILY OF RADIOS WHEN THE TOE IS REVISED AND EQUIPMENT AVAILABLE.)

Figure 5-6. Typical radio net, engineer float bridge company.

5-11. Communications

Radio facilities are provided for communication between elements of the company and between the company and higher headquarters

(fig. 5-6). Telephone facilities are provided, when required, for communication between the company elements and higher headquarters (fig. 5-7).



○— TELEPHONE SET, TA-312/PT

Figure 5-7. Typical wire diagram, engineer float bridge company.

5-12. Training

a. The engineer float bridge company commander is responsible for training in accordance with ATP 5-35. The company also assists in training other units in the erection and use of floating equipage. When practical, a com-

bined army training test in conjunction with an engineer combat battalion provides a realistic training vehicle.

b. In the supervision of training, the company commander assures adequate cross-training and service school specialist training of assigned personnel.

CHAPTER 6

ENGINEER PANEL BRIDGE COMPANY

Section I. CHARACTERISTICS AND EMPLOYMENT

6-1. General

The engineer panel bridge company is a separate company which is normally assigned to a field army or separate corps and attached to an engineer combat group. The engineer panel bridge company provides personnel and equipment to load, transport, and maintain the panel bridge and gives technical advice and assistance in its erection. The panel bridge company is fully mobile and 100 percent air transportable (FM 101-10). TM 5-277 describes the component parts, methods of loading, transporting, assembling and launching the panel bridge Bailey type M2.

6-2. Capabilities

a. At full strength, the engineer panel bridge company is capable of—

- (1) Loading, transporting, and maintaining one panel bridge set, Bailey type, M2, consisting of bridge erection equipment and the components for two 24-meter, double-truss, single-story, widened roadway, panel-type bridges, or one 40-meter, double-truss, double-story, widened roadway, panel-type bridge (fig. 6-1).
- (2) Providing technical advice and assistance for erecting panel bridges.
- (3) Erecting panel bridges with organic personnel at a significantly reduced rate of speed.
- (4) Providing 5-ton dump trucks for earthmoving and general cargo hauling with approximately 160-ton capacity per lift by off-loading organic bridging.
- (5) Performing organizational maintenance on its equipment.

b. The engineer panel bridge company has a limited capability of defending itself and its installations against hostile ground attack.

6-3. Employment

a. The company transports the bridging to the crossing site, and furnishes bridge specialists and supervisors to assist in its erection. Normally, the equipment provided by the company is erected by elements of the supported engineer organizations.

b. Additional bridging beyond the organic authorizations is transported by the company from the supply facility. Transport capability is provided by off-loading organic equipment at the work site or at a forward bridge park.

c. The company is trained to erect its own bridging, and it may be called upon to do so when other engineer combat troops are not available. However, the tactical situation usually requires completion of the bridge in less time than can be achieved by the limited manpower of the company alone.

d. The company may be required to furnish bridge guards and maintain erected bridging.

e. The company normally procures a new load of bridging from a bridge park as its organic bridging is emplaced. Other companies in the rear may later disassemble the bridge and return its components to depot stock.

f. When the situation warrants, the group Commander may direct the company to unload its bridging and utilize the dump trucks for hauling bulk construction materials. When possible, the bridge should be off-loaded by bays to expedite reloading. The company operates most effectively in support of a combat battalion by the assignment of mission-type tasks rather than by attachment. The company has sufficient

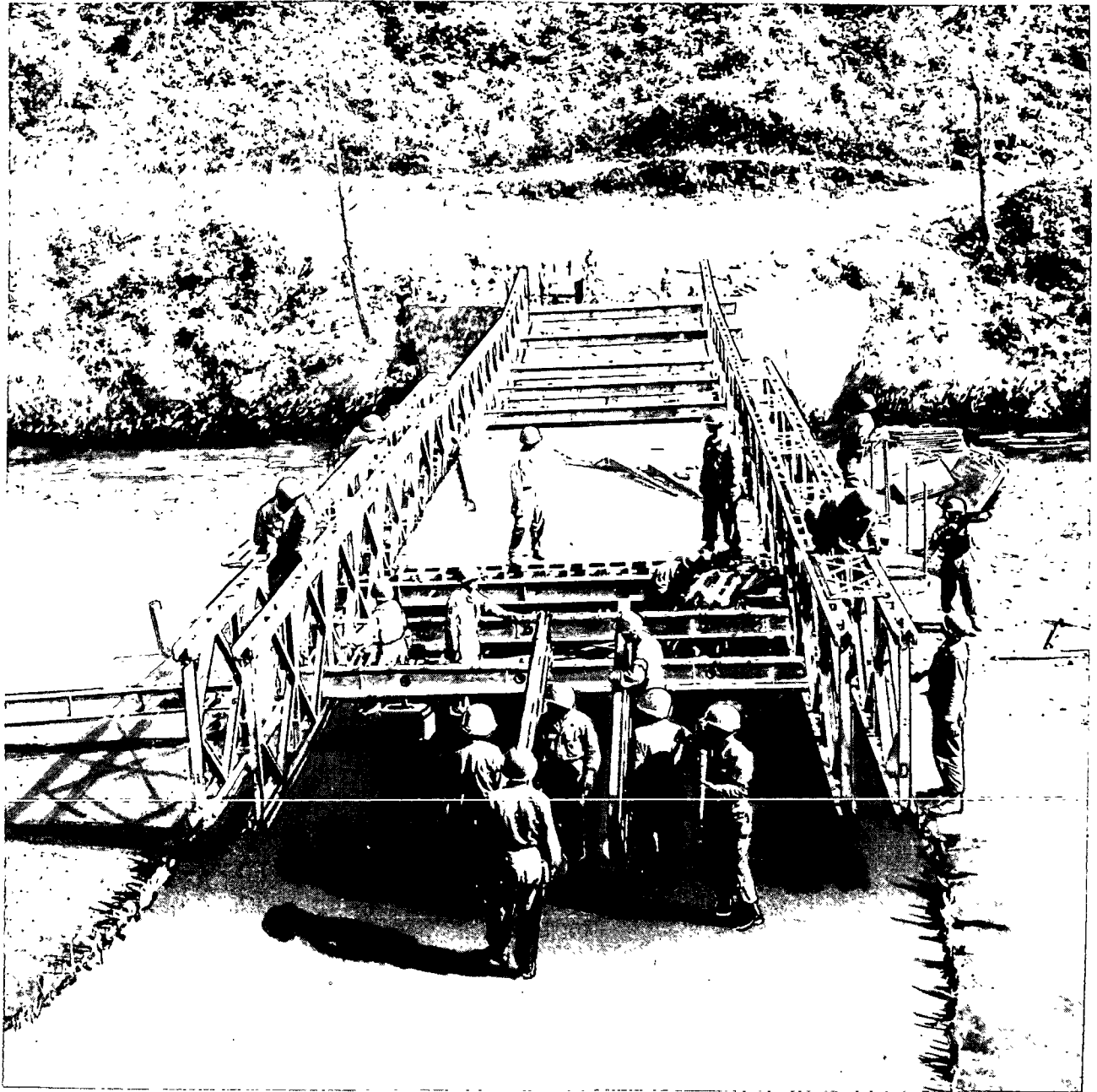


Figure 6-1. Engineers constructing a Bailey Bridge.

supervisors and equipment for a hauling operation, and it can be further augmented with similar equipment and operators from the light equipment company. The company can

be given a mission of operating a borrow pit and delivering materials where needed. Three to six hours should be allowed for reloading bridging under ideal conditions.

Section II. COMPANY ORGANIZATION AND PROCEDURES

6-4. General

The engineer panel bridge company is organized under TOE 5-77 and consists of a company headquarters and two bridge platoons (fig. 6-2).

6-5. Company Headquarters

The engineer panel bridge company headquarters is organized and functions in a manner similar to that of the engineer float bridge company headquarters (para. 5-5). An equipment and maintenance section is included within the headquarters to provide organizational maintenance for organic equipment.

6-6. Bridge Platoon

The bridge platoon is the basic operational unit of the panel bridge company. The platoon is normally employed with the rest of the company but may participate in independent platoon operations. The bridge platoon loads, transports, and maintains one-half of the panel bridge set authorized the company (24 meters) and provides technical advice and assistance in the erection of the panel bridge.

6-7. Administration and Supply

Administrative and supply procedures are similar in nature to those outlined for the engineer float bridge company (para. 5-9).

6-8. Communications

Radio facilities are provided for operation of internal communications and for communicating with higher headquarters and supported units (fig. 6-3). Standard field telephone and wire equipment is furnished to provide wire communications between the company and higher headquarters and between the company and the bridge platoons (fig. 6-4).

6-9. Training

The engineer training of the panel bridge company is conducted within the company. However, when the company is attached to an engineer group, training is coordinated with the group headquarters. Specialist training may be conducted at platoon level in sections supervised by the platoon leader or section leader. Every opportunity should be taken to

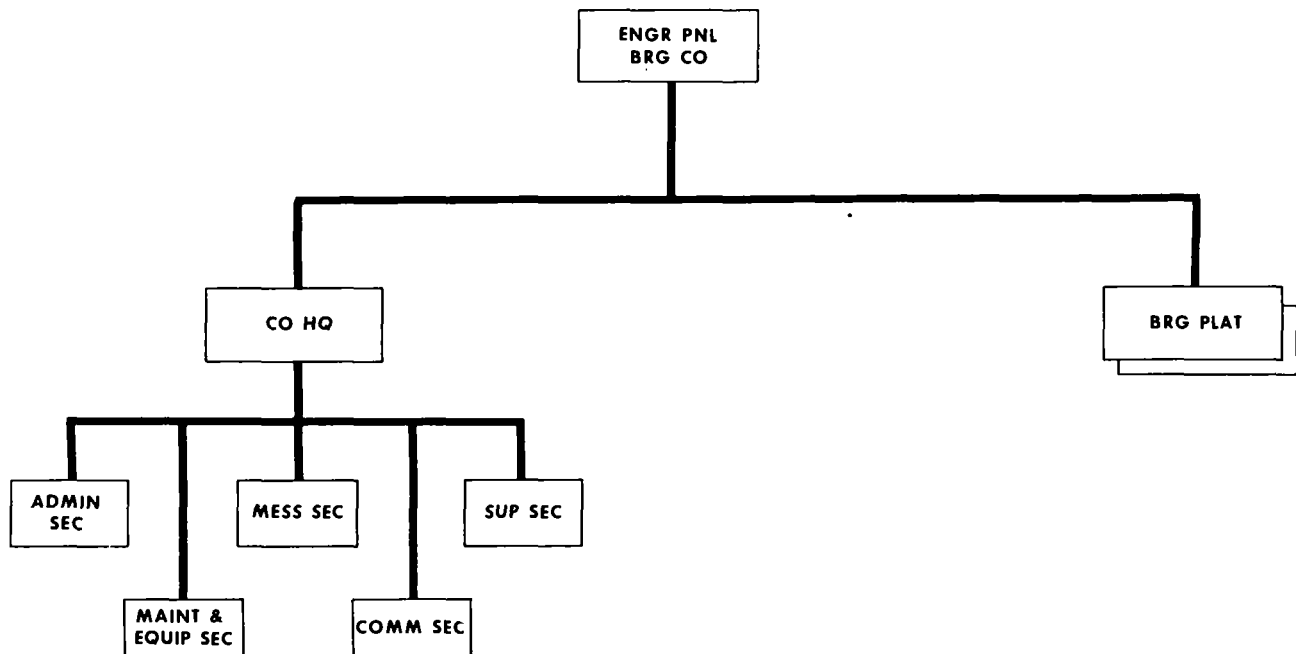
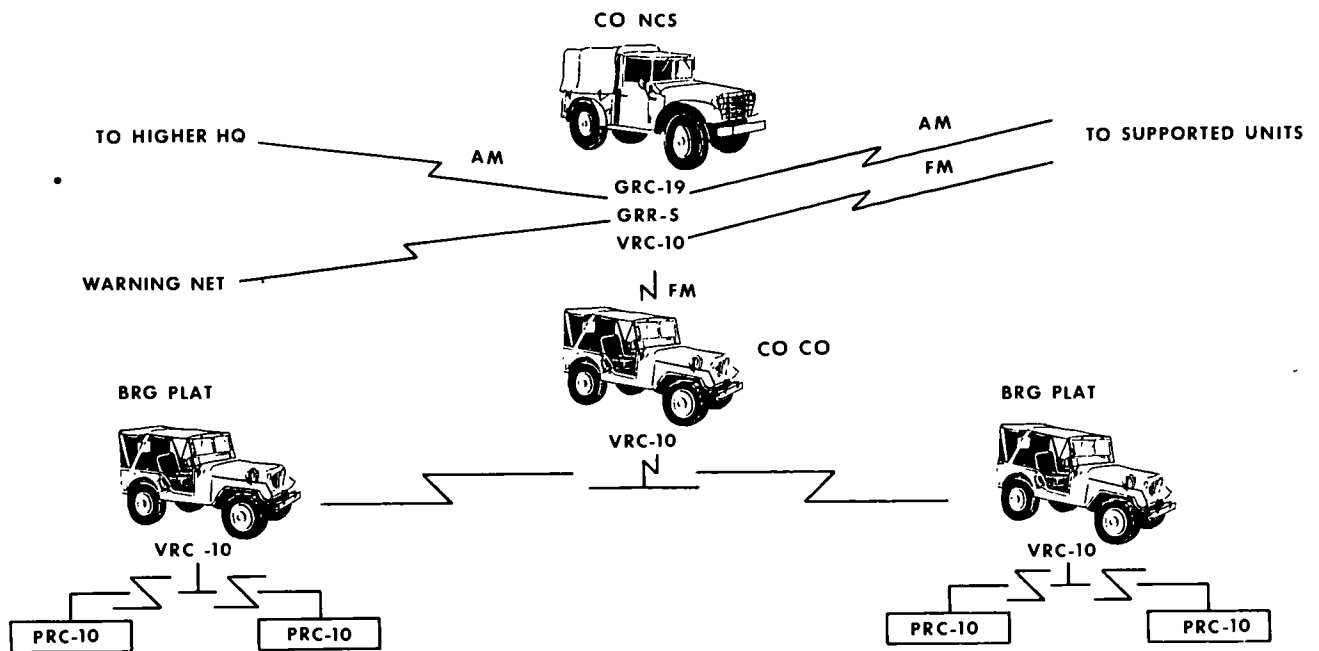
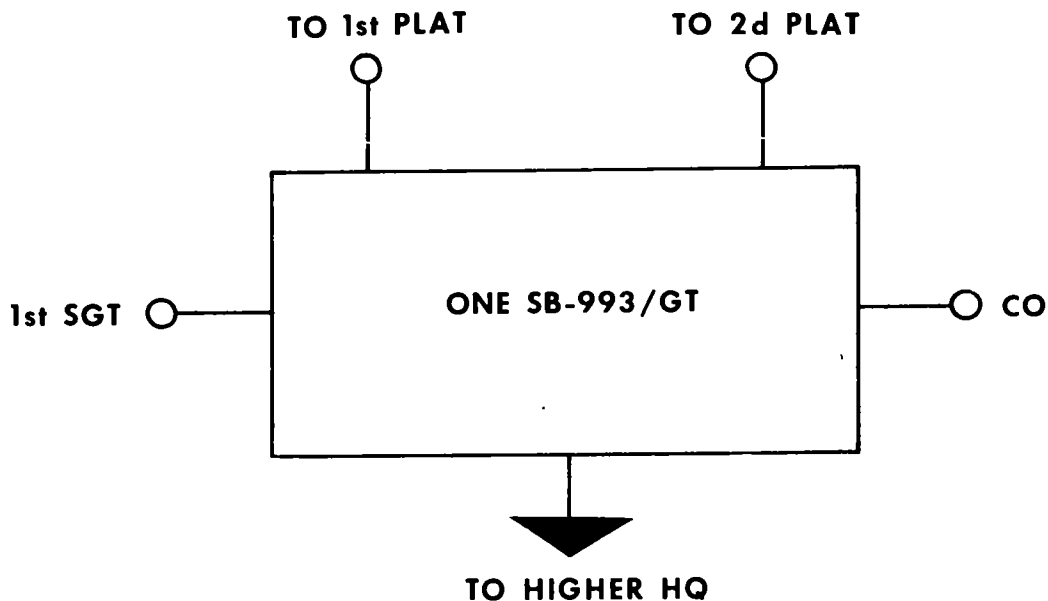


Figure 6-2. Organizational chart, engineer panel bridge company.



(NOTE: RADIOS CURRENTLY AUTHORIZED WILL BE REPLACED BY THE NEW FAMILY OF RADIOS WHEN THE TOE IS REVISED AND EQUIPMENT AVAILABLE.)

Figure 6-3. Radio net, engineer panel bridge company.



○ TELEPHONE, TA-312/PT

Figure 6-4. Wire net, engineer panel bridge company.

utilize school quotas for specialist training. The company assists in training other units in the erection and employment of the panel bridge.

CHAPTER 7

ENGINEER LIGHT EQUIPMENT COMPANY AND ENGINEER LIGHT EQUIPMENT COMPANY (AIRBORNE)

Section I. CHARACTERISTICS AND EMPLOYMENT

7-1. General

a. *The engineer light equipment company* is a separate company normally assigned to a field army and attached to an engineer combat group. The engineer light equipment company provides, operates, and maintains a concentration of engineer construction equipment in support of engineer combat units. The company is fully mobile and 100 percent air transportable (FM 101-10).

b. *The engineer light equipment company (airborne)* is also a separate company and is normally assigned to an independent airborne corps. The engineer light equipment company (airborne) provides, operates, and maintains a concentration of specialized construction equipment initially to support airborne division engineer battalions in the construction of airstrips within the airhead, and subsequently, to support them in other engineering tasks. The company is fully mobile. Although the organization of both types of engineer light equipment companies is similar, the airborne company is provided with equipment suited to Stage I, Phase I and II airborne operations (FM 101-10 and AR 705-35). The following discussion is applicable to both units unless specifically noted.

7-2. Capabilities

a. The engineer light equipment company is capable of—

- (1) Operating in support of engineer combat battalions.
- (2) Providing two-shift operation of construction equipment.
- (3) Providing organizational maintenance of organic equipment and direct sup-

port maintenance of organic engineer equipment.

b. The engineer light equipment company has a limited capability of defending itself against hostile ground attack.

7-3. Employment

a. The engineer combat group to which the light equipment company is attached normally attaches equipment, operators, and maintenance personnel to engineer combat battalions within the group for specific tasks. Specialized equipment, such as the crushing and screening plant, is usually placed in general support of group units. Support is provided by the most practical method and situations may vary from the attachment of individual items of equipment with operators to attachment of complete sections or platoons depending on the magnitude of the mission. When the company, platoon, or section is engaged in support of other units, the supported unit is responsible for worksite supervision and operational control; the officers and noncommissioned officers of the light equipment company serve as advisors and supervisors as directed by the supported unit commander. Supported units are responsible for providing messing facilities and security personnel for equipment and personnel for the light equipment company operating at job sites. Security is especially important at night when the equipment and operating personnel stay at the job site.

b. The engineer light equipment company may be assigned specific missions which require only equipment and can be accomplished as a platoon or company project. However, the company does not have the capacity for supervising

construction tasks requiring troop labor since all its personnel are directly engaged in the operation or maintenance of equipment.

c. The company may also provide equipment and operators in support of divisional engineer battalions when directed.

Section II. COMPANY ORGANIZATION AND PROCEDURES

7-4. General

The engineer light equipment company provides personnel and equipment to support or augment the combat construction efforts of an engineer combat group. The equipment organic to this company serves as a pool of engineer equipment for other elements of the group which either do not have specialized equipment or need augmentation. Organized under TOE 5-54, the company consists of a company headquarters, three equipment platoons, an equip-

ment support platoon, and a maintenance platoon (fig. 7-1).

Note. In the engineer light equipment company (airborne), the functions of the equipment support platoon and maintenance platoon are consolidated into one unit, an equipment and support platoon, which does not have a direct support maintenance capability (fig. 7-2) (for further details, see TOE 5-54).

7-5. Company Headquarters

The company headquarters is the command element of the company. Personnel are provided for command, communications, administrative, mess, and supply activities.

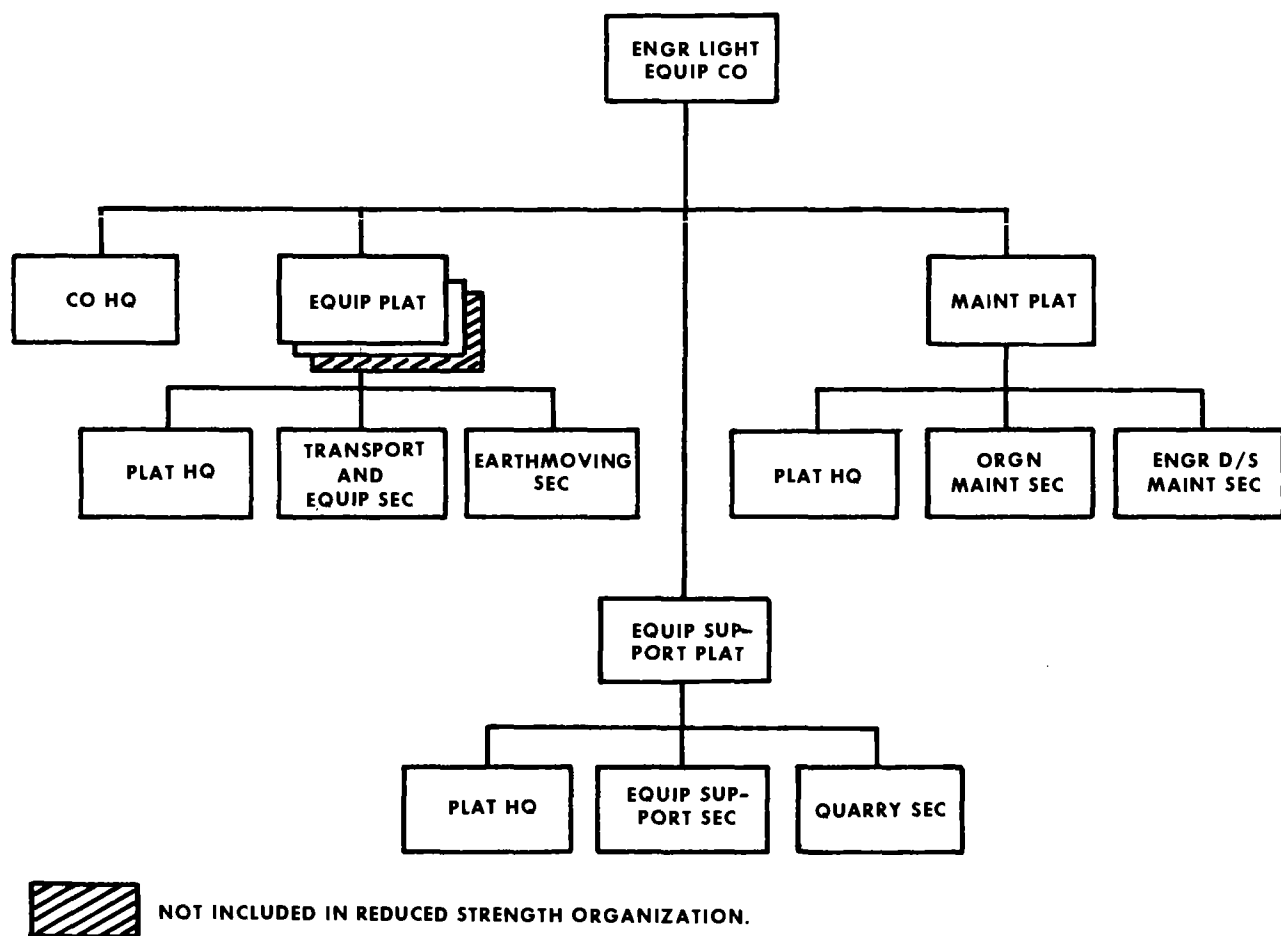


Figure 7-1. Organizational chart, engineer light equipment company.

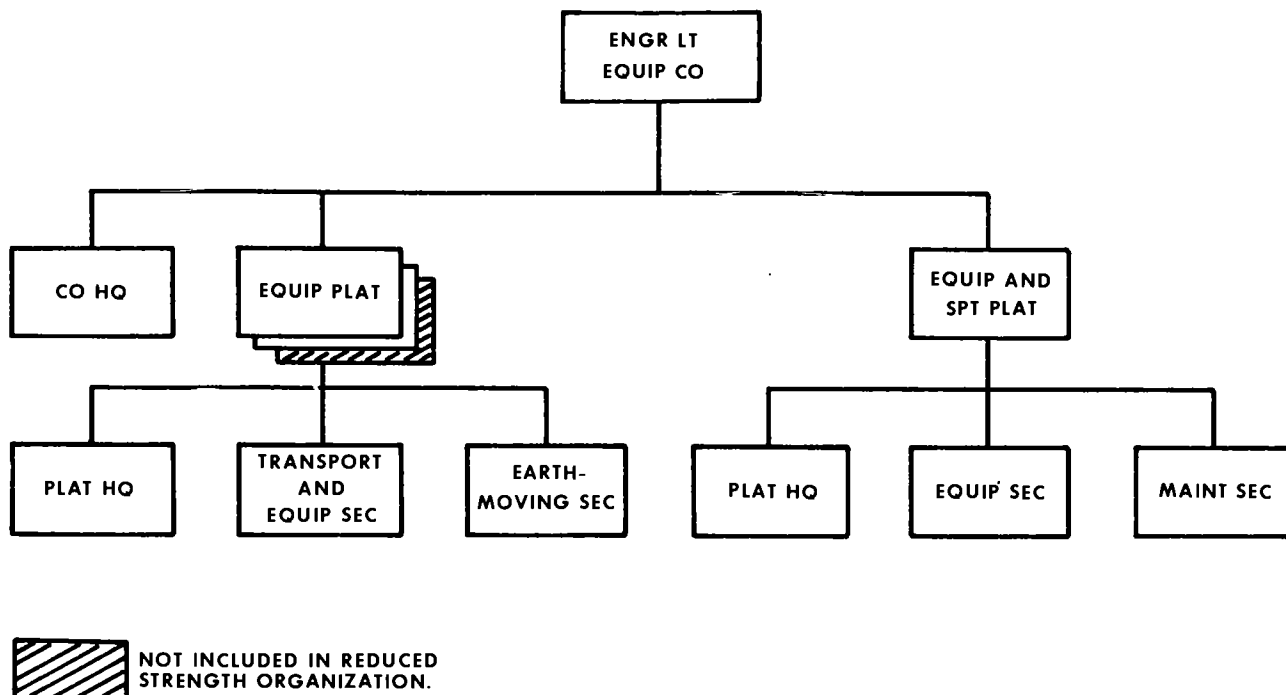


Figure 7-2. Organizational chart, engineer light equipment company (airborne).

7-6. Equipment Platoon

Three equipment platoons provide personnel and equipment (such as cranes, scoop loaders, motorized road graders, towed scrapers, in-trenching machines, tractors with dozer blades, and dump trucks) to support general earthmoving construction projects (fig. 7-3). Equipment within these platoons is balanced to meet the normal support requirements of three engineer combat battalions. Each platoon is functionally organized into a platoon headquarters, a transport and equipment section, and an earthmoving section.

a. Platoon Headquarters. The platoon headquarters contains the necessary personnel for supervision, control, and coordination of platoon activities.

b. Transport and Equipment Section. This section provides personnel, transportation, and specialized equipment to support the platoon in earthmoving tasks.

c. Earthmoving Section. This section provides personnel and general earthmoving equipment required for earthmoving projects.

7-7. Equipment Support Platoon

This platoon provides specialized construction support equipment with operators and is organized with a platoon headquarters, an equipment support section, and a quarry section.

a. Platoon Headquarters. The platoon headquarters contains personnel for supervision, control, and coordination of platoon activities.

b. Equipment Support Section. This section provides personnel and specialized construction support equipment such as piledriving equipment, asphalt heaters, asphalt distributor, water distributor, rollers, and earth auger.

c. Quarry Section. This section provides personnel and equipment for operation of the 25-cubic-yard-per-hour crushing and screening plant and auxiliary equipment used in quarry operations (fig. 7-4).

7-8. Maintenance Platoon

The platoon performs organizational maintenance on all organic equipment and direct support maintenance on organic engineer con-

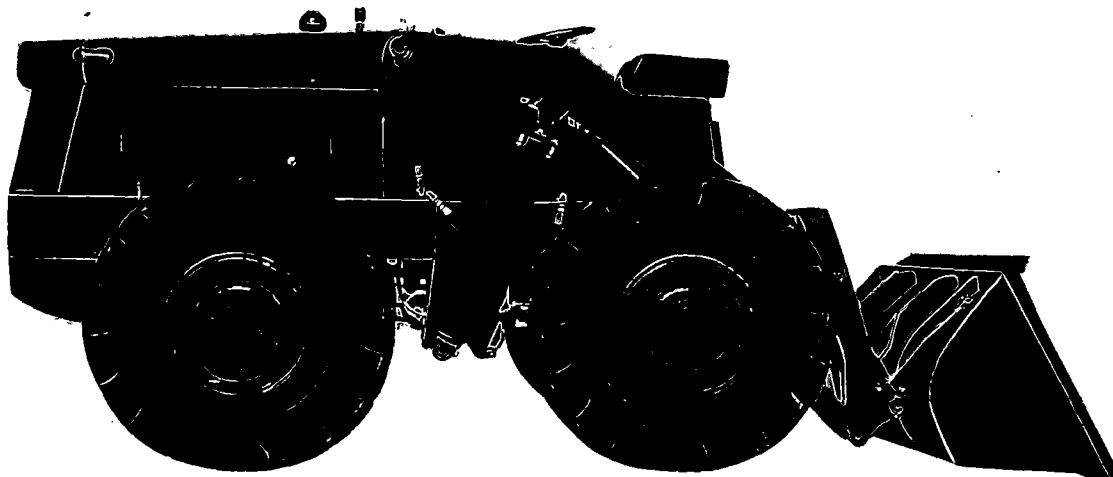
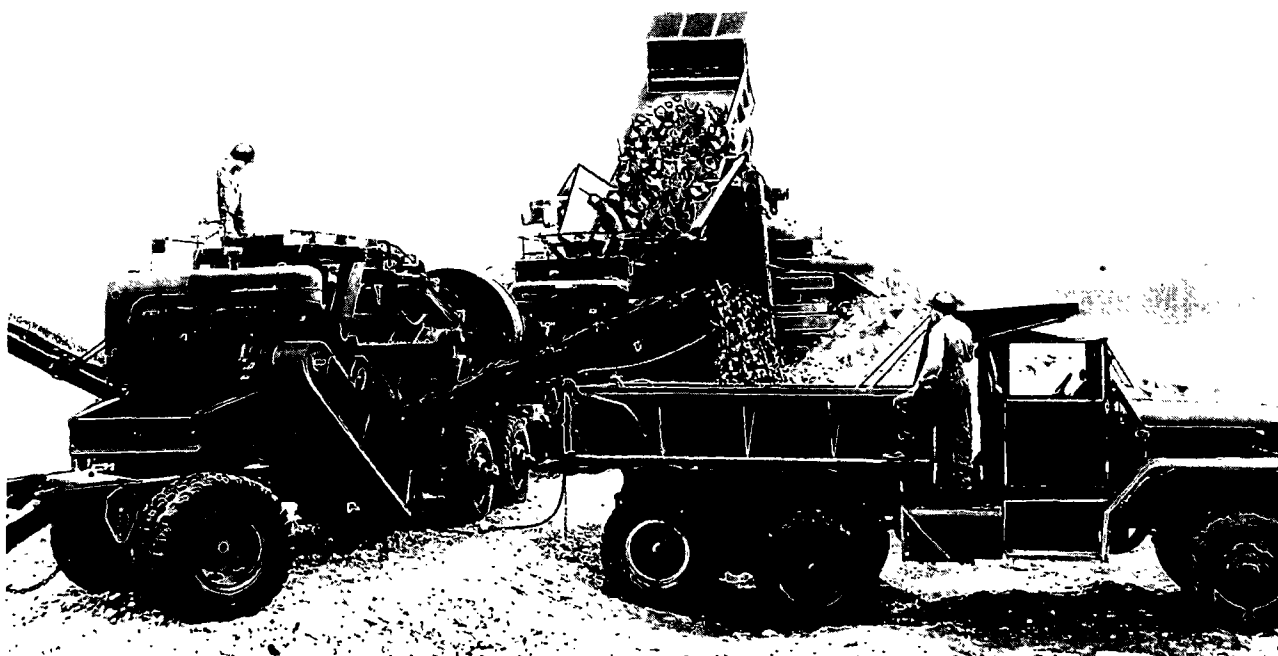


Figure 7-3. Two-and-one-half-cubic-yard scoop loader.



*Figure 7-4. Crushing and screening plant in operation
(25-cu.-yd. unit).*

struction equipment. It is organized into a platoon headquarters, an organizational maintenance section, and a direct support maintenance section.

a. Platoon Headquarters. The platoon headquarters contains personnel for supervision, control, and coordination of maintenance activities.

ENGINEER LIGHT EQUIPMENT COMPANY

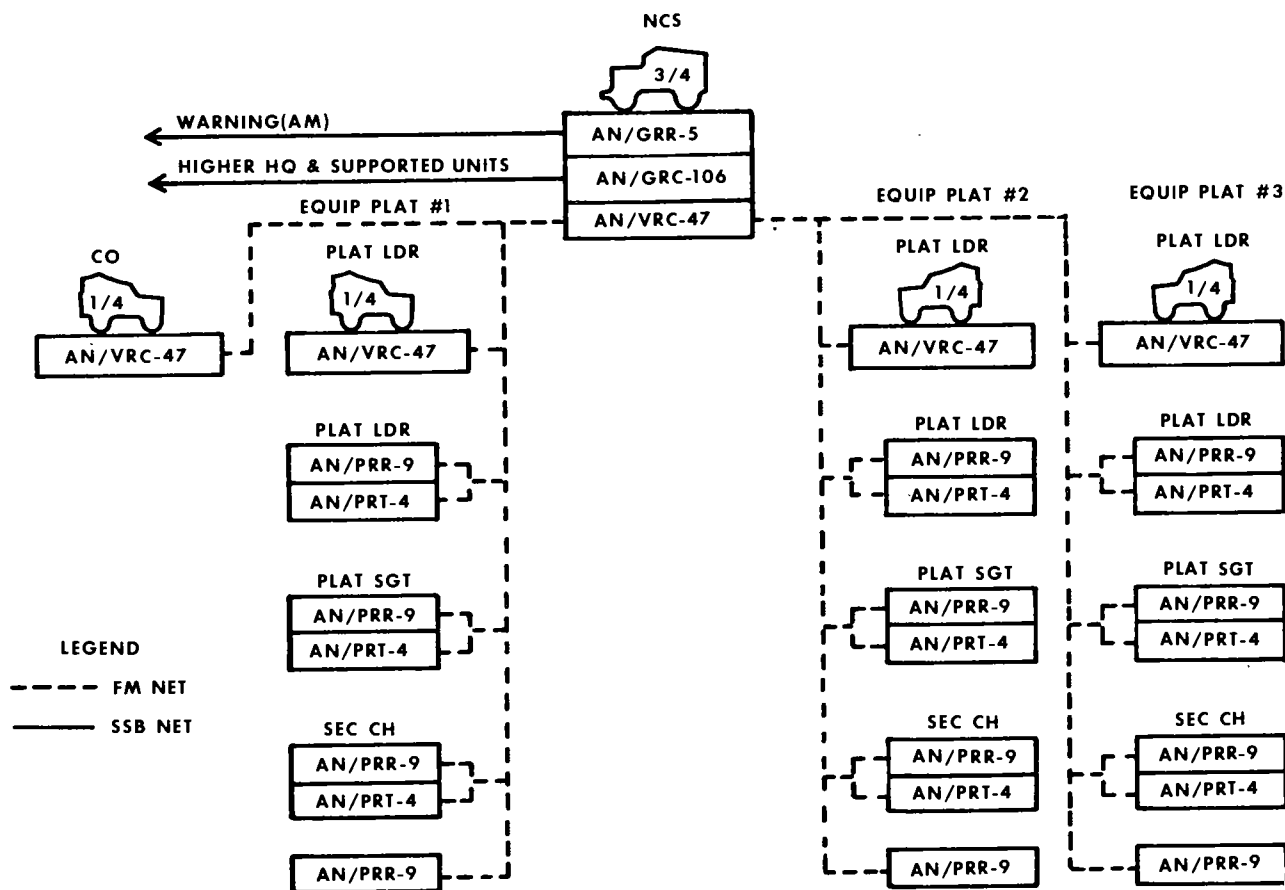


Figure 7-5. Typical radio net, engineer light equipment company and engineer light equipment company, airborne.

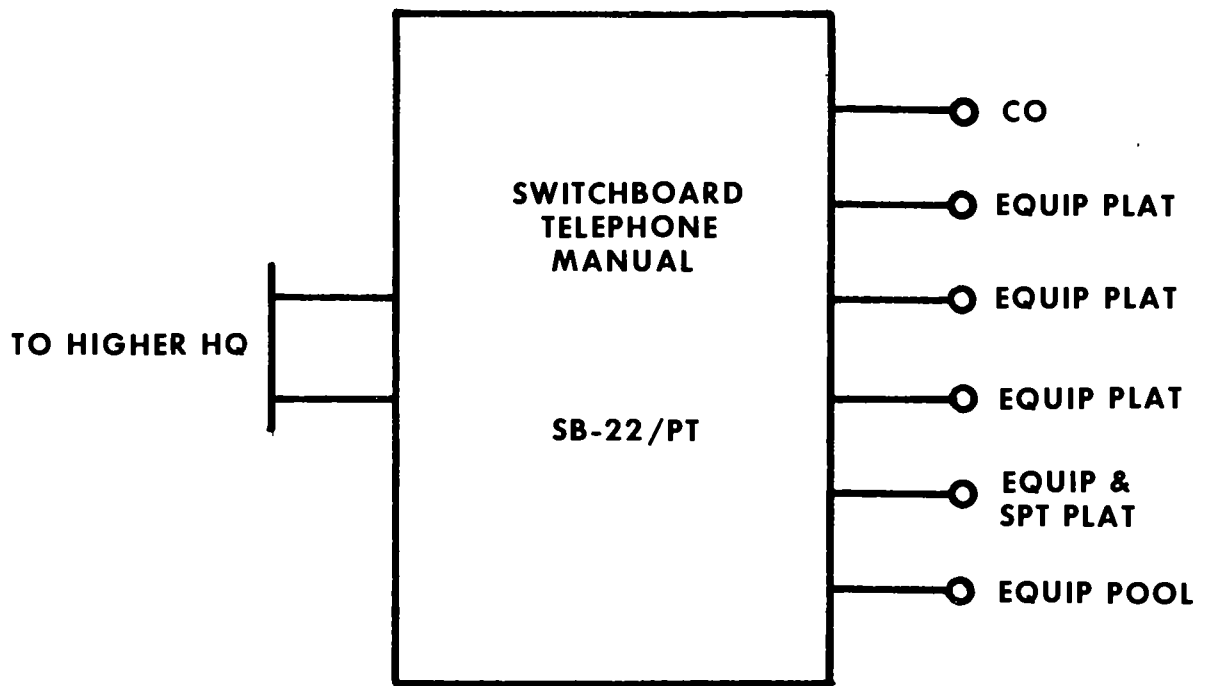
b. *Organizational Maintenance Section.* This section provides personnel and equipment to perform organizational maintenance on organic vehicular and engineer equipment. To provide centralized POL distribution and control, POL trucks are authorized for this section.

c. *Engineer Direct Support Maintenance Section.* This section contains personnel and equipment to provide direct support maintenance for engineer equipment organic to the

company. This section also provides contact maintenance terms for on-site repair of engineer equipment.

7-9. Administration and Supply

Administrative and supply procedures for the engineer light equipment company are similar to those outlined for the engineer float bridge company (para. 5-9).



° TELEPHONE TA-312/PT

Figure 7-6. Typical wire diagram, engineer light equipment company and engineer light equipment company (airborne).

7-10. Communications

a. In the engineer light equipment company, radio facilities are provided for communication between the company and higher headquarters and between the company and each of its platoons (fig. 7-5).

b. Both the engineer light equipment company and the engineer light equipment company (airborne) provide wire communication be-

tween company and platoons (fig. 7-6) and between the company and higher headquarters.

7-11. Training

Training is supervised by the company commander, in accordance with training policies and directives of group headquarters (ATP 5-35). Emphasis is placed on cross-training of all equipment operators.

CHAPTER 8

ENGINEER DUMP TRUCK COMPANY AND ADM TEAMS

Section I. ENGINEER DUMP TRUCK COMPANY

8-1. General

The engineer dump truck company (fig. 8-1) is a separate company suitable for employment in both the combat zone and the communications zone. It is assigned to a field army and attached to an engineer combat group. For a discussion of this unit in a construction support role, see FM 5-162, Engineer Construction and Construction-Support Units.

8-2. Mission and Capabilities

The engineer dump truck company provides and operates dump trucks for the movement of bulk materials in support of divisional and other nondivisional engineer combat units. The dump truck company consists of a company headquarters, a service section, and two dump truck platoons and is organized under TOE

5-124. At full strength this unit is capable of moving from 240 cubic yards (struck load) to 312 cubic yards (heaped load) of bulk material such as gravel, earth, or crushed stone per trip. The amount of material that this unit can haul in one day depends on various factors such as weather conditions, distance of haul, roadway, material, or loading facilities. The dump truck company is 100 percent mobile and air transportable (FM 101-10). This unit has a limited capability of defending itself against hostile ground attack.

8-3. Employment

a. The engineer dump truck company is usually attached to, or placed in support of, an engineer unit engaged in the construction or repair of roads, railroads, aircraft landing

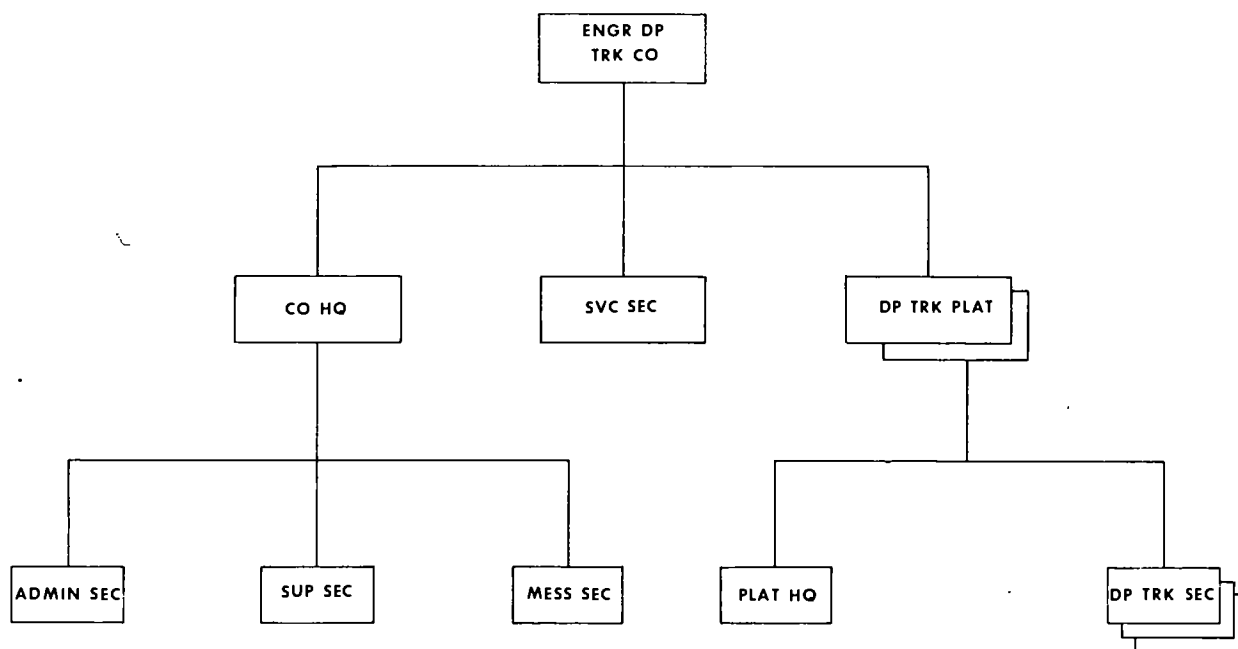
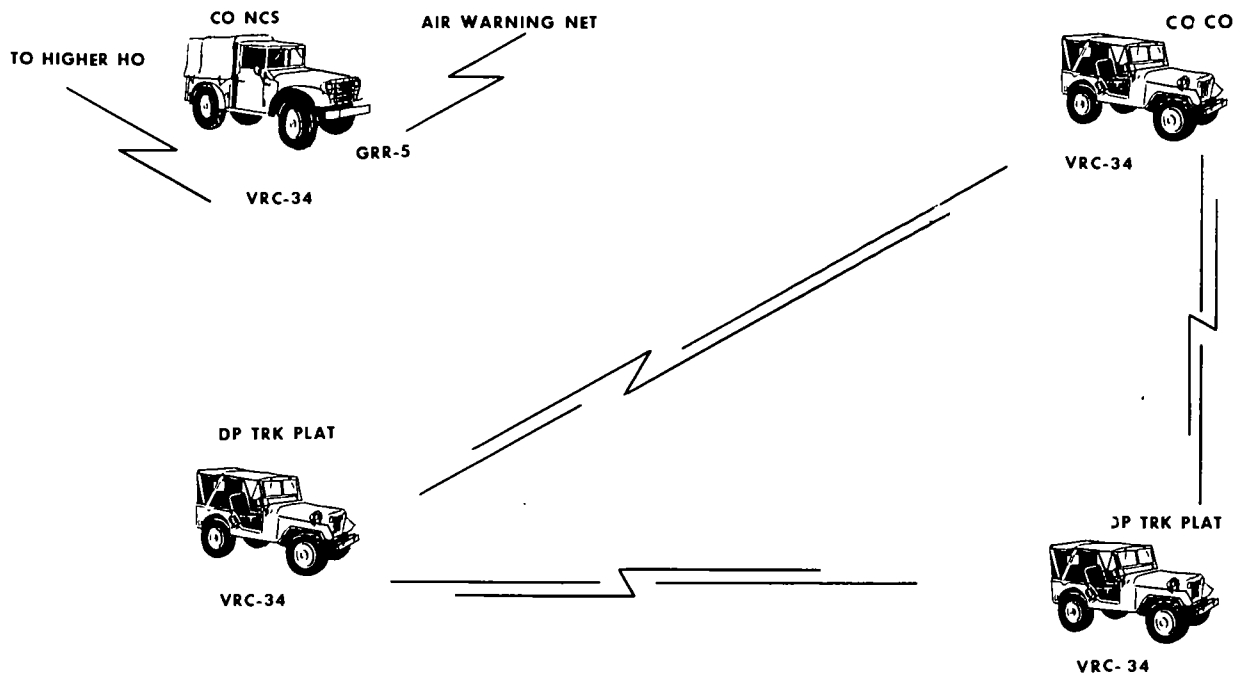
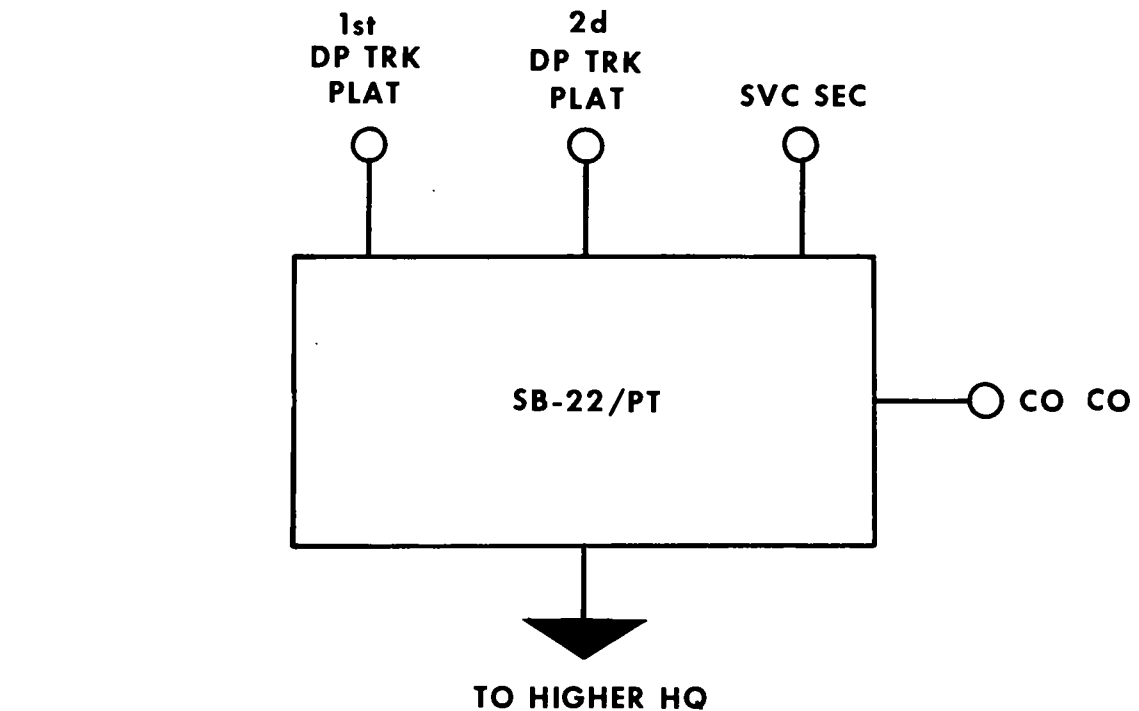


Figure 8-1. Organizational chart, engineer dump truck company.



(NOTE: RADIOS CURRENTLY AUTHORIZED WILL BE REPLACED BY THE NEW FAMILY OF RADIOS WHEN THE TOE IS REVISED AND EQUIPMENT IS AVAILABLE)

Figure 8-2. Typical radio net, engineer dump truck company.



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Figure 8-3. Typical wire diagram, engineer dump truck company.

facilities, field fortifications, or other tasks requiring the movement of large quantities of bulk materials. The supported unit is normally responsible for loading the trucks. When subordinate units of the dump truck company are attached to another unit, company headquarters remains with the larger element at a central location to permit servicing of the equipment. If significant distances are involved and subordinate units are widely separated, a portion of the company service section may reinforce the maintenance capabilities of the supported unit. When vehicles and personnel are attached to another unit, that unit is responsible for the proper operation and maintenance of the vehicles. The company operates most effectively on mission-type assignments under the control of its own commander.

b. Employment of dump trucks should be based upon approximately 75 percent of the organic vehicles being available at a given time. This permits the company to schedule the required periodic maintenance inspections and minor repair.

8-4. Communications

The dump truck company provides telephone communication between the company headquarters and the service section, and between the company headquarters and each of the dump truck platoons. It provides radio communication between the higher headquarters, company headquarters, and the dump truck platoons. Figure 8-2 shows the radio net and figure 8-3 shows the wire net.

Section II. ATOMIC DEMOLITION MUNITIONS TEAMS

8-5. General

To provide nondivisional combat engineers with the capability of atomic demolition munitions (ADM) employment within the field army area, and to augment divisional combat engineers, ADM teams have been established by TOE 5-500. Upon assignment of a unit ADM mission, ADM teams are attached in accordance with the type, magnitude, and number of ADM targets. In order to achieve maximum flexibility and to reduce manpower and training requirements, three types of ADM teams have been organized: Team MA, ADM platoon headquarters, separate; team MB, ADM liaison; and team MC, ADM squad. Teams are dependent upon the unit to which attached for administrative and logistical support and security.

8-6. Team MA—Atomic Demolition Munitions Platoon Headquarters, Separate

Team MA, ADM platoon headquarters consists of the platoon leader and five enlisted assistants with the necessary equipment to command and control from two to six ADM

squads. The platoon headquarters provides supported units with technical liaison, advice, and limited planning concerning the employment of atomic demolition munitions.

8-7. Team MB—Atomic Demolition Munitions Liaison

Team MB, ADM liaison consists of one nuclear weapons employment officer who provides technical knowledge, advice, and limited planning to the unit to which attached in the employment of atomic demolition munitions. Additionally, Team MB performs liaison between the headquarters to which attached and supporting ADM teams.

8-8. Team MC—Atomic Demolition Munitions Squad

Team MC, ADM squad, consists of the squad leader and two ADM specialists. This team assembles, prepares for firing, detonates on order, recovers, disassembles, or destroys ADM. This team is dependent upon the unit to which attached for ADM storage, resupply, transport, security, site preparation, and administration.

CHAPTER 9

ORGANIZATION FOR COMBAT EMPLOYMENT

Section I. GENERAL

9-1. Combat Engineer Units of a Typical Field Army

A fixed organization is not prescribed for the field army. However, for discussion in this chapter a type field army is considered to have three corps each consisting of two mechanized divisions, one infantry division, and one armored division. Aside from the division engineer battalions, the number and type of engineer combat units in a type field army depends on the requirements for combat engineer troops to support tactical operations. Figure 1-1 shows a type disposition of nondivisional engineer combat units in a typical field army.

9-2. Corps Area

a. Mission. Corps engineer operations render direct support to division engineer units and assist nondivisional troops of the corps. Corps engineer units are frequently employed to supplement the engineer effort of divisions and to take over a large proportion of the engineer tasks in division rear areas thus freeing division engineers to concentrate in forward areas. Works accomplished by corps engineer units frequently exhibit a greater capability for sustained use than those of division engineers whose first concern is expediency (fig. 9-1).

b. Methods of Employment.

- (1) Normal missions assigned to corps engineer elements are general support, direct support, or task assignment. Attachment to a combat force is sometimes appropriate. Usually, it is desirable to assign each group a combination of missions: general support of the corps by accomplishing all engineer tasks within a specified area; direct support of a committed division by a specified element of the

group; and accomplishment of specified tasks possibly in the forward portion of a division area. Normally, the area assigned to the group under a general support mission will include all or part of the rear portion of one or more division areas as well as a portion of the corps rear area. The amount of direct support effort required by a committed division will vary considerably but one battalion is usually appropriate. Typically, corps engineer elements perform engineer tasks forward to the general vicinity of the divisional brigade rear boundaries in a general support (area responsibility) role. Within the divisional brigade sectors, corps engineer elements work on a specific task basis or in a direct support role. In the direct support role, the commander of the direct support element coordinates directly with the supported division, usually through the division engineer. Tasks performed by corps engineer elements within a division area, whether on a general support, direct support, or task assignment basis, must meet the technical requirements of the division engineer. Corps engineer units usually are not attached to a division unless the division is operating at a considerable distance from the bulk of the corps or the engineer group commander finds it difficult to exercise proper control of the operation for some other reason.

- (2) Group areas of responsibility may be assigned by dividing the corps area laterally or longitudinally depending upon the particular situation. The

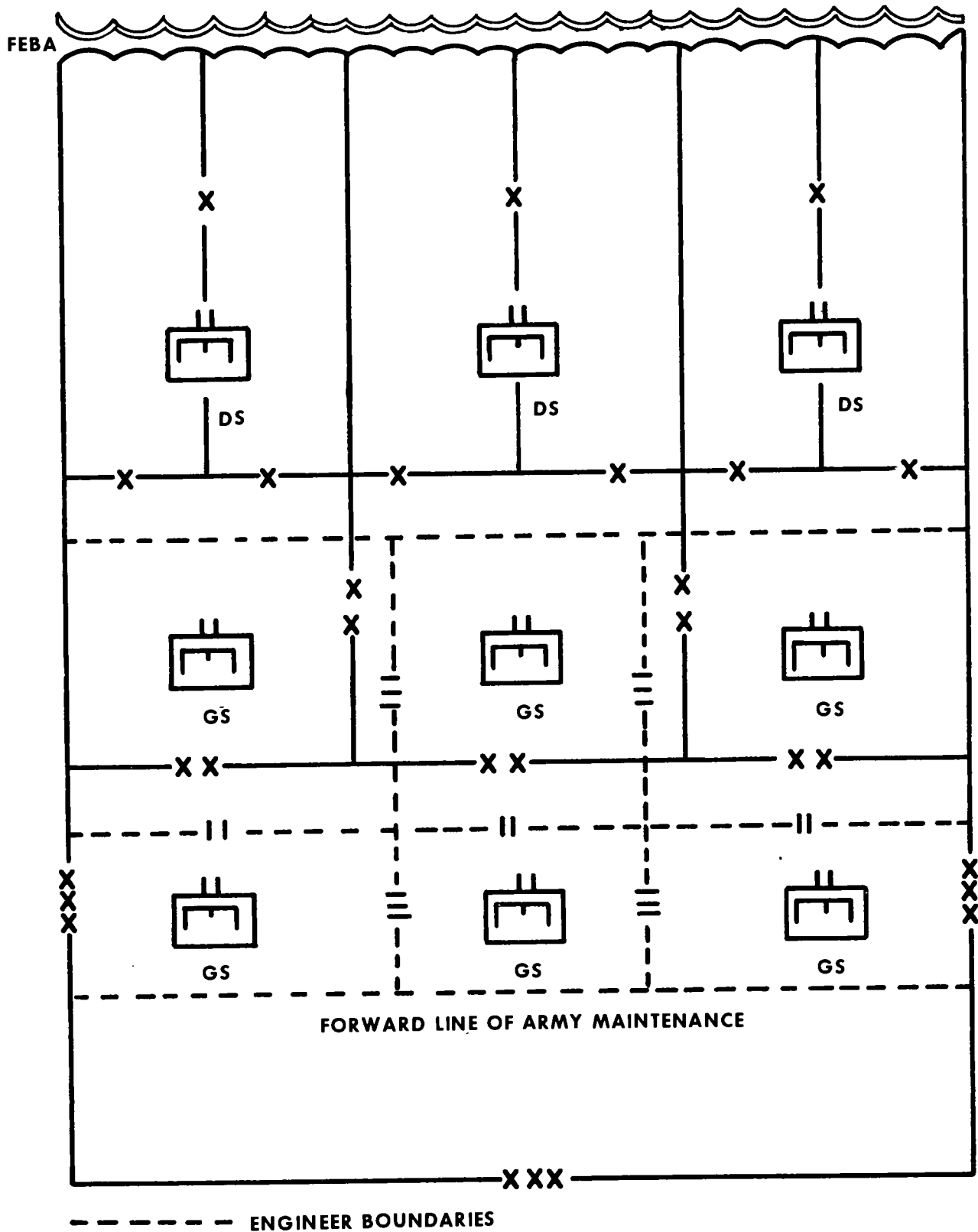


Figure 9-1. Typical corps area divided into engineer combat group support.

assignment of areas to battalions within the groups may also be made by boundaries generally perpendicular to the front or by boundaries parallel to the front. Placing the battalions abreast allows better control and places each battalion in a position where it can take over work in the service area of the echelon to its front. On the other hand, placing battalions in column so that they can be leapfrogged forward permits employment of one unit in the same area for the maximum length of time.

- (3) The following factors should be considered in assigning areas to units for engineer work:
 - (a) The overall mission.
 - (b) The road net.
 - (c) The amount of engineer work in the designated area.
 - (d) The amount of interference from the enemy and from road congestion and other activities of friendly troops.
 - (e) The ease of communication and control. An area roughly square in shape makes control more simple than does one which is long and narrow.
 - (f) The strength of engineer units available.
 - (g) The amount and condition of heavy equipment.
 - (h) The tactical situation.

9-3. Army Area

a. *Mission.* Army engineers support corps operations in a manner similar to corps engineers in support of division operations; that is, they assume responsibility for engineer tasks well forward in the corps area. At division and corps level, the emphasis of engineer effort is placed on the support of operational plans. At army level, engineer operations place more emphasis on the development of facilities to provide longer-term support.

b. *Methods of Employment.*

- (1) Generally, area assignment missions are given to field army nondivisional engineer combat units. However, task assignments or a combination of both

types of missions may be given.

- (2) Normally, one army engineer combat group is placed in support of each corps. The group is assigned an area and is responsible for general engineer work throughout the area. Groups generally sub-allot areas of responsibility to attached engineer battalions and assign them appropriate missions.

9-4. Liaison

The establishment of liaison with the supported unit is essential for successful engineer operations. Liaison is the responsibility of both parties; however, liaison personnel are furnished by the supporting unit. Usually, the nondivisional engineer combat battalion supporting a division maintains a liaison officer at the battalion headquarters of the division engineers or at the office of the assistant division engineer. The supporting engineer unit commander must assure adequate liaison; therefore, he must make whatever arrangements are necessary.

9-5. Administration

Battalions and separate companies of the engineer brigade and engineer combat groups are administratively self-supporting. In some cases, administrative functions of attached units are performed at group headquarters by unit administrative personnel under the supervision of the group adjutant.

9-6. Supply

a. *Supply Accounts.* Each of the separate engineer companies and each battalion establishes supply accounts with supporting supply agencies. The brigade S4 and group S4 enter into supply channels only under exceptional circumstances to assist and expedite the receipt of supplies and to establish priorities.

b. *Water Processing and Purification.*

- (1) Planning the potable water supply for supported units is an important function of the engineer brigade and group. The principal element of this function is the production of potable water. The water processing and purification capability of the engineer group is provided by the engineer

combat battalions. The group S4 plans water point operations and provides staff supervision of potable water activities for the group commander. Detailed reconnaissance is performed by a battalion acting either under group orders or on its own initiative. Orders for water point reconnaissance are initiated by the group S4.

- (2) Usually when the battalion installs an advanced water point, one water point in the rear is closed or turned over to a water processing and purification team of another unit. In a rapidly-moving situation it is best not to commit all five teams of the battalion simultaneously.
- (3) A water point team is not entirely self-sufficient. Access roads and any clearing or grading must be provided by other engineers. If traffic control is a problem, the assistance of military police is obtained by request through the engineer group headquarters. The security of the water point must be assured; security is normally provided by the unit to which the team is attached. Water points frequently will be at a distance from battalion headquarters. In such cases, the water point team may be attached to a nearby engineer combat company, the commander of that company becoming responsible for the support of the water point and personnel including accessory construction, security, and subsistence (TM 5-700).
- (4) In the absence of orders to the contrary, water points serve all units requesting water. Users provide their own containers and transportation for water. When requirements for water exceed the water transport capability of the user, transportation units deliver water from the water point to the consumer. Control of water consumption is a function of command, and the battalions enforce limitation of water as directed by higher authority.

9-7. Maintenance

a. Categories of Maintenance.

- (1) The four categories of maintenance are (AR 750-1)—
 - (a) Organizational maintenance.
 - (b) Direct support maintenance.
 - (c) General support maintenance.
 - (d) Depot maintenance.
- (2) The scope of each of these categories may be found in the maintenance allocation chart in the appropriate technical manual.
- (3) Organizational maintenance is performed by all using units. When a unit is authorized and capable of performing maintenance in a category other than organizational maintenance, it will be so indicated in the TOE under the "Capability" statement. Each commander is responsible for maintenance of his equipment within the category of maintenance authorized his unit.

b. Engineer Maintenance.

- (1) Since engineer units contain many items of engineer equipment, the necessary maintenance to insure continued operation of these items is a major consideration. Engineer equipment requires regular maintenance even under the best of operating conditions. During operations in northern, tropical, desert, and mountainous areas, or during adverse weather conditions, or in a CBR environment, maintenance requirements greatly increase. Unit commanders are responsible for establishing and maintaining regular maintenance programs and schedules under all conditions. All engineer units perform organizational maintenance on organic engineer equipment. In addition, the engineer light equipment company has a direct support maintenance capability for organic engineer equipment. Direct support maintenance of the engineer equipment of other nondivisional engineer combat units is provided by a designated direct support maintenance unit.

- (2) *Contact Maintenance.* It is usually easier and faster to move maintenance personnel to heavy construction equipment than to move the equipment. For this reason, contact repair is established to provide mobile parties of mechanics with repair parts and special equipment, who, in addition to repairing the equipment, render all possible assistance to the using troops through inspection and technical advice.

c. Ordnance Maintenance.

- (1) The serviceability of ordnance items is also of great concern to the engineer unit commander. Proper organizational maintenance, regular maintenance practices, and familiarity with the maintenance services provided by direct support maintenance units will help engineer combat support units to keep essential ordnance equipment operationally ready.
- (2) Organizational maintenance of ordnance equipment is performed by the using unit. Direct support maintenance of this equipment is provided by a designated direct support maintenance unit. When an ordnance item requires direct support maintenance, it is normally evacuated to the supporting direct support maintenance unit for repair and return. In emergencies and in other cases where on-site repair is more practicable, repair may be accomplished by contact maintenance teams. Liaison is maintained between the engineer unit and the supporting maintenance unit for the interchange of information and for the establishment of mutually acceptable working relationships.
- (3) When requesting on-site repair, the engineer unit must inform the supporting maintenance unit of the location of the equipment; the nature of the malfunction, if known; and any other information that may assist the maintenance unit in organizing and equipping the work party (e.g., any known repair parts requirements would be indicated). The engineer

unit may also be required to furnish a guide to the equipment site.

- (4) Liaison between the supporting maintenance unit and the engineer unit is a matter of routine. The maintenance unit frequently dispatches liaison parties to the engineer unit to discuss maintenance requirements, problems, and procedures, and to provide advice and assistance on the maintenance of ordnance materiel. The engineer unit may request additional advice and assistance at any time; frequently, the scope of such requested advice and assistance will result in the dispatch of a technical assistance team from the supporting maintenance unit.
- (5) An effective maintenance program is also dependent on accurate, complete, and timely equipment records. For details on records associated with equipment maintenance, their preparation, processing, and disposition, see TM 38-750.

d. Responsibility. Responsibility for maintenance exists at all levels of command and extends down to the individual operator. Each commander is responsible for the planning and organization of an effective maintenance program and for the training, indoctrination, inspection, and coordination of his command to insure careful use of equipment and satisfactory maintenance (DA Pam 750-1). Higher commanders, their staffs, and inspection teams frequently inspect equipment and assist in maintenance problems. Specialized maintenance units perform maintenance of a higher order than the organizations can accomplish; but this does not relieve the commander from his responsibilities.

9-8. Communications

a. Adequate communications are necessary for successful engineer operations. The elements of the engineer brigade and group are usually widely dispersed; nevertheless, engineer tasks are normally of immediate and critical importance. Rapid changes in the operational environment similarly affect combat engineer support. Under these circumstances, the ability of a commander to direct and con-

trol operations is dependent upon reliable communications.

b. Group headquarters within the corps area operates within the brigade communication net in accordance with the signal operating instructions (SOI) published by the brigade. All units attached to a combat group normally operate within the group communication net which is controlled by the group communication section.

c. When the requirement for telephone communications exceeds the group organic capability, service is established by request to the nearest area signal center. The corps or army signal officer can provide the location of the nearest installation. The need for reliable signal communications often governs the location of the group headquarters and the headquar-

ters of assigned or attached engineer units (FM 24-18 and FM 24-20).

9-9. Construction

The nondivisional engineer combat units construct, maintain, and repair roads, fords, culverts, fixed and floating bridges, pipeline systems, obstacles, aircraft landing facilities, command posts, supply installations, and shelters (fig. 9-2). Since transportation, materials, equipment, and manpower are usually limited, only essential tasks are undertaken and simple designs are employed to conserve time and materials.

a. Roads.

- (1) The ground mobility of a field army is influenced by the number and condition of the roads over which it must

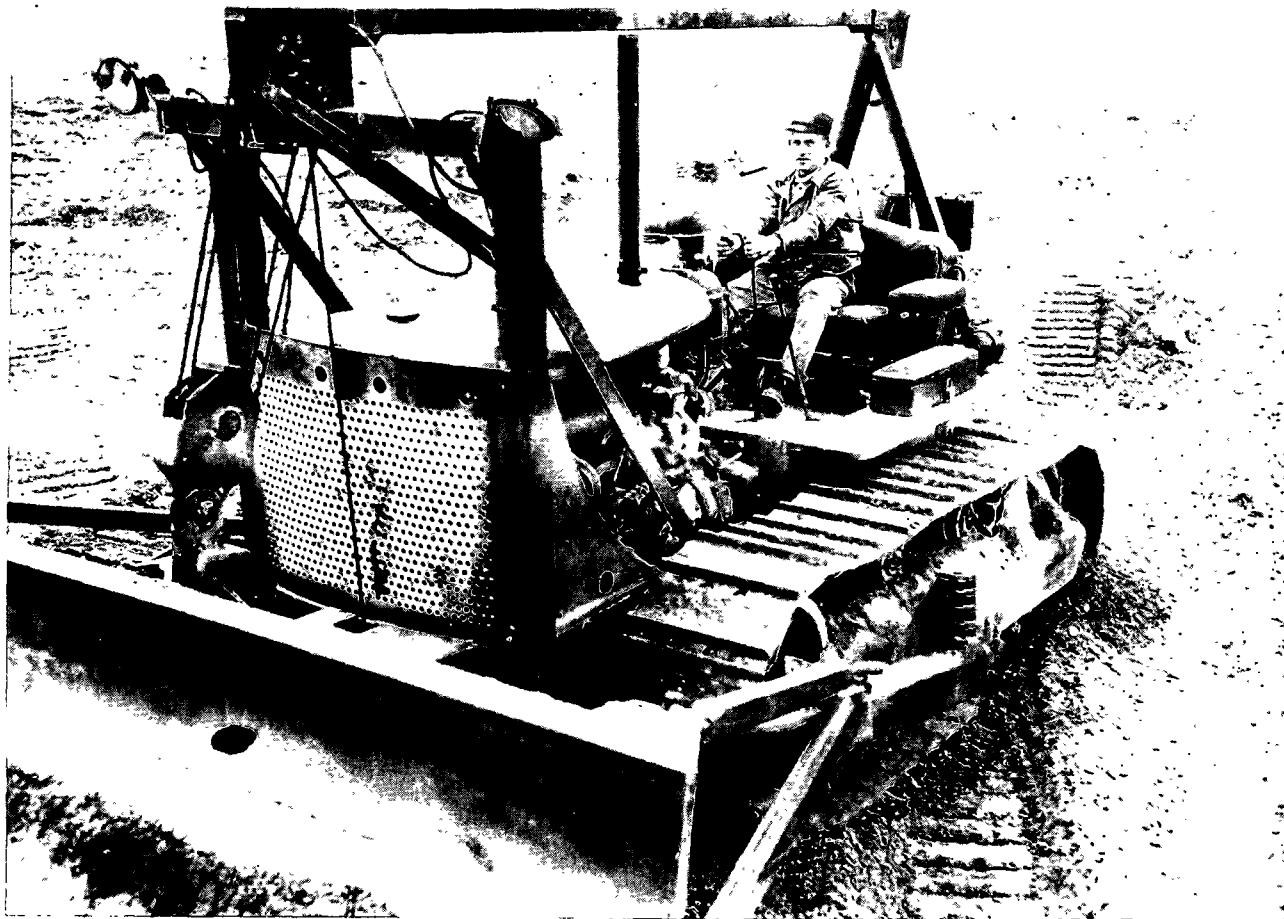


Figure 9-2. Dozer in engineer construction.



Figure 9-3. Engineers maintaining a road.

move. The existing road net is rarely adequate for the intense traffic and heavy loads of a modern army, and it must be widened, improved, and constantly maintained (fig. 9-3). Engineer combat units are usually employed on road construction and repair more than on other categories of work.

- (2) Road improvements and repairs must be accomplished rapidly making the best use of local resources. The road must be able to stand up under hard use and plans must allow for expansion and improvement of the road as well as accommodation of immediate need. Roadwork is progressive in character. Hasty repair of existing roads and installation of temporary bridges necessary for the passage of combat elements are followed by im-

provement and new construction successively more deliberate and permanent. The work is complicated by factors not present in civil construction. For example, construction cannot await good weather or ideal materials (fig. 9-4). It cannot interrupt traffic. Worksites are often subject to fire from enemy artillery, air, or ground troops.

- (3) An engineer combat battalion is, in most cases, assigned responsibility for the road net in a given area. Orders designate the maintenance of existing roads and new roads to be built; but in the early stages orders do not prescribe materials, design, or methods. The battalion commander insures that roads in his area accommodate military traffic without delay. Work on the road net, however, is not complete

with initial repairs or improvements. When portions of the road net are damaged, repairs must be prompt. The battalion commander must be continuously informed about the condition of the road net so that he can quickly adjust the assignment of equipment, materials, and labor to critical points. Frequently, tentative battalion areas may be predicted by the direction and rate of movement of friendly forces. The battalion prepares plans based on information gained from preceding units, reconnaissance, and aerial imagery.

- (4) For further discussion of reconnaissance, design, construction, and maintenance of military roads, see TM 5-330.

b. Bridges.

- (1) Tactical bridging is one of the most important tasks of the nondivisional engineer combat units. The combat battalions must be well trained in the

erection of the equipment of the engineer bridge companies and in the construction of other types of bridges (fig. 9-5) including expedient bridges.

- (2) Tactical bridge equipment is replaced as soon as possible with semipermanent fixed bridges, fills, or culverts. Combat battalions will frequently replace bridges. Since the tactical bridge must remain in place until its substitute is ready, and since this equipment may be urgently needed in other locations, this work is usually critical. The bridge company may assist in dismantling the bridge and removing it from the site, but usually a combat battalion will be responsible for this work.

- (3) For further discussion of bridges, see FM 5-34, FM 31-60, TM 5-210, TM 5-216, and TM 5-312.

c. General Construction.

- (1) The combat battalion or group may be called upon to build structures,



Figure 9-4. Maintenance of snow-packed road.

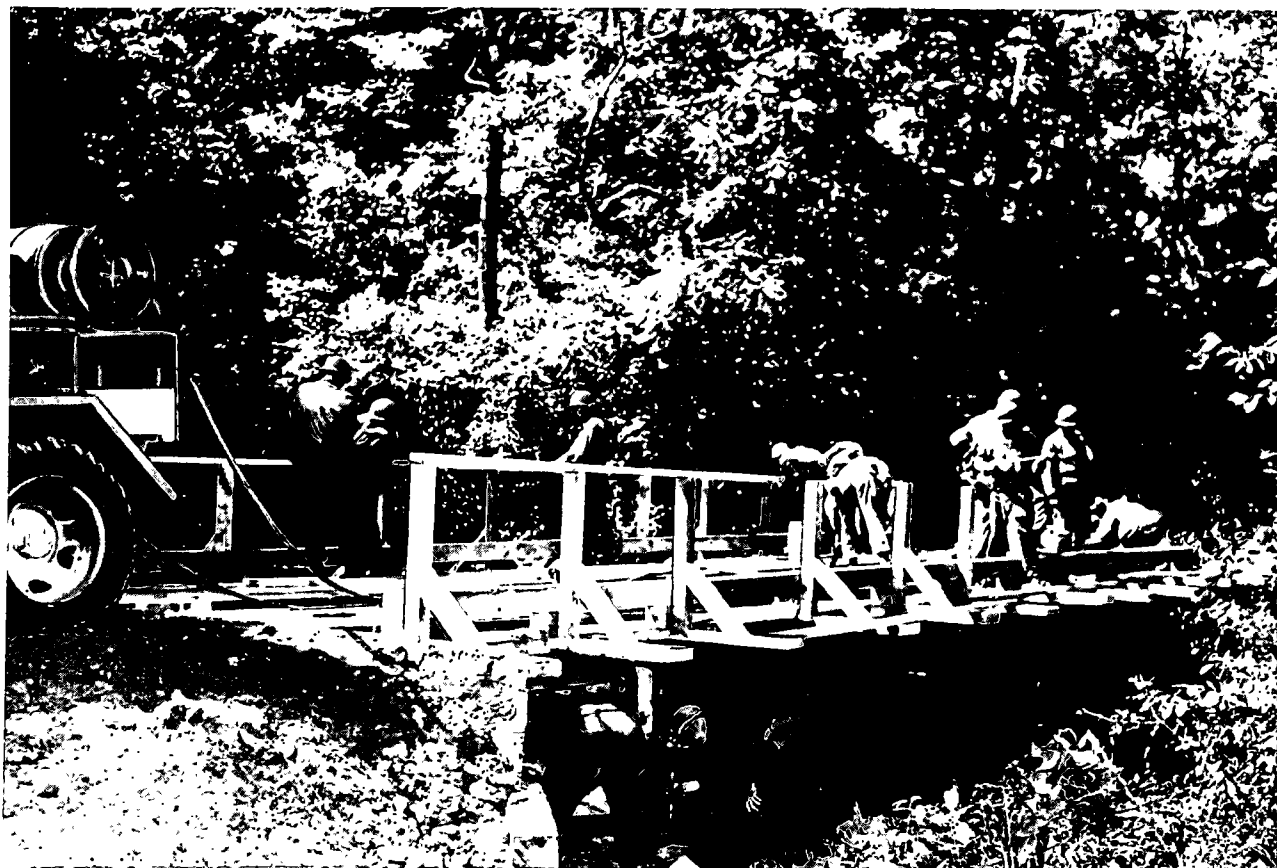


Figure 9-5. Construction of a timber bridge.

such as storage and supply facilities, and to construct aircraft landing facilities. Structures will conform, whenever possible, to the standard plans contained in TM 5-302. Layout and site drawings, when necessary, may be provided by the S3 of the engineer brigade or group but frequently will be left to the discretion of the battalion commander. The battalion requisitions the material and any special equipment needed. Sometimes, however, the engineer brigade or group S4 arranges in advance for battalion credit at the appropriate supply point or depot. Aircraft landing facility construction is explained in TM 5-330.

- (2) The battalion commander has considerable latitude in the details of repairs and alterations to existing

structures, and he normally allows similar latitude to his company commanders by issuing mission type orders. Complete plans or portions of plans contained in TM 5-302 should be used when applicable. If the user of the structure is available, he is consulted, but the project officer does not provide unnecessary additions and refinements which drain material and manpower.

- (3) It is not the intent in any portion of this discussion on construction to leave the impression that sound principles of construction are sacrificed for the sake of expediency. In any construction project which requires a great deal of excavation and if the tactical situation permits, every effort should be made to determine from former engineer drawings whether

there are underground pipelines, water and sewage lines, telephone cables or electrical power lines buried in the area. If portions of damaged bridges are used, and it is intended to span a damaged section with a panel bridge, every effort should be made to determine the design and strength of the section not damaged. When a nondivisional engineer unit builds any structure such as a bridge, POL storage facility, hospital, depot facility, or airfield, a set of as-built drawings should be made and filed with the group, brigade, corps, and army engineer sections. These plans are extremely important if the construction includes any underground utilities. When time does not permit the preparation of as-built drawings, signs should be prepared and placed over areas of buried utilities indicating their location.

9-10. Training

a. Purpose. The increased dispersion and frequent displacement of units in modern war-

fare requires greater responsibility, a higher degree of initiative, greater ingenuity, and a higher degree of technical proficiency of individuals at all echelons. Training is conducted in order to insure increased efficiency in management and utilization of equipment, personnel, and resources available to commanders. Detailed planning and practical construction methods are necessary to provide rapid and economical execution of both complex and simple engineer tasks. Training will be conducted under the provisions of ATP 5-35.

b. Responsibility. The commanders of units attached to the engineer combat group are responsible to the group commander for training their units.

c. Training Materials. Fundamental training doctrines and principles are outlined in FM 21-5; and specific techniques of military instruction are given in FM 21-6. Special training instructions are published in training circulars, subject schedules, and periodic training directives. Training generally follows the army training program (ATP) provided by the Department of the Army. Training films, film strips, and visual training aids should be used when possible.

Section II. PLANS AND MISSION ASSIGNMENTS

9-11. Introduction

Except in training and during periods of rest and recuperation, the engineer brigade or combat group does not bivouac as a unit, and only in administrative movements does the combat group move as an organization. Moreover, the engineer combat group is seldom employed on a single project. Rather, the mission of the engineer group is normally accomplished by subdividing the task as a whole into clearly defined battalion missions. Only general supervision, coordination, and the support of the separate companies of the group are provided. Exceptions to this rule are group action in ground combat, preparation of rear area defensive positions, and river crossings.

9-12. Plans

a. The successful execution and timely completion of engineer tasks require thorough planning. A task is rarely completed without

encountering unforeseen difficulties; however, careful planning reduces such obstacles to a minimum and provides for the orderly completion of the work in the allotted time. The engineer commander gathers reliable information, estimates carefully the requirements of his task, fits his resources to those requirements, and insures the fulfillment of his mission. This is engineer planning. It involves considering all predictable elements and visualizing the execution of the task from start to finish. Concurrent planning at successive echelons is a further requisite.

b. Detailed planning is done by the individual directly responsible for the task. It is progressively less detailed at higher levels. For example, when a battalion is employed as a unit on a single task, battalion engineer planning is sufficiently detailed to insure that work assignments and equipment and material allocation are adequate for the task at hand and best

suited to the battalion's capabilities. It must necessarily consider methods best suited to the job, but the methods considered are not dictated to the company commander to whom the work is assigned. The unit commander must be free to make his own plan lest he be deprived of the opportunity to exercise his own initiative as well as his sense of responsibility for the results achieved. On an important or very complex job, however, the subordinate commander is often called upon to present his plan to his commander. Where two or more companies are performing interdependent elements of a job, coordination may require limitations on the discretion of subordinate commanders

and the development of more detailed plans at higher echelons.

c. Planning is not terminated with the completion of an initial plan for a particular mission or phase of operations but is continuous. As operations progress, plans must be reviewed and revised as new factors develop. Furthermore, planning must envision probable future developments. For example, in an offensive operation the assignment of work in an area immediately forward of that in which a battalion is employed is often almost a certainty. Plans for much of the work anticipated in that area should be prepared, even if only in tentative form, before receipt of orders.

CHAPTER 10

COMBAT EMPLOYMENT

Section I. THE OFFENSE

10-1. Duties

Nondivisional engineer combat units will often be required to assist combat organizations in the offense during the movement to contact and the attack. The duties of engineers in movement to contact and in offensive operations are similar and will be considered together. A list of engineer duties may include the following:

- a. Engineer reconnaissance.
- b. Repairing and maintaining roads and trails for troop movement, supply, and evacuation.
- c. Constructing bridges and bypasses.
- d. Assisting in flank security by preparation of obstacles.
- e. Breaching, neutralizing, or destroying all types of obstacles that hinder forward movement of the supported forces.
- f. Constructing forward aircraft landing facilities (fig. 10-1).
- g. Preparing and maintaining fords, and ingress and egress points for amphibious vehicles.

10-2. The Engineer Combat Group in Support of a Division

a. The group, at the outset of the attack, takes over the divisional engineer battalion's responsibilities in the divisional rear area as a part of the group's general support mission. This is accomplished by battalions of the group located in the corps area immediately behind the division rear boundary. These battalions will be employed on area and task assignments working forward into the division area to an informal boundary agreed upon by the group commander and the division engineer. As the attack advances, the group will progressively extend its boundary forward to relieve the

divisional engineer battalion. When required, elements of the rear battalions may be given specific assignments further forward.

b. Regardless of the seniority of supporting engineer unit commanders, the commander of the division engineer battalion remains the division engineer and directs the engineer work in the division area through liaison with the supporting units or through recommendations to the division commander.

10-3. Engineer Combat Group (Army) in Support of a Corps

a. The operations of an engineer combat group (army) in support of the corps closely parallel the operations of a corps engineer group in support of a division. Upon receipt of orders from the army engineer to support a corps, the group commander makes personal contact with the corps engineer to arrange the details of support and required liaison. Contact between the corps engineer brigade and the army engineer group is maintained by a group liaison officer supplemented by frequent visits to the brigade by the group commander. The corps engineer provides work assignments for the group in accordance with its capabilities and the overall corps mission. Generally, an army engineer combat group supporting a corps will be assigned an area of responsibility in the corps area which will permit corps engineer units to concentrate forward in support of the divisions.

b. Supporting missions which the army engineer combat group may be called upon to perform in support of a corps are:

- (1) Maintenance of routes.
- (2) Replacement of tactical bridges.
- (3) Clearance of minefields and other obstacles.

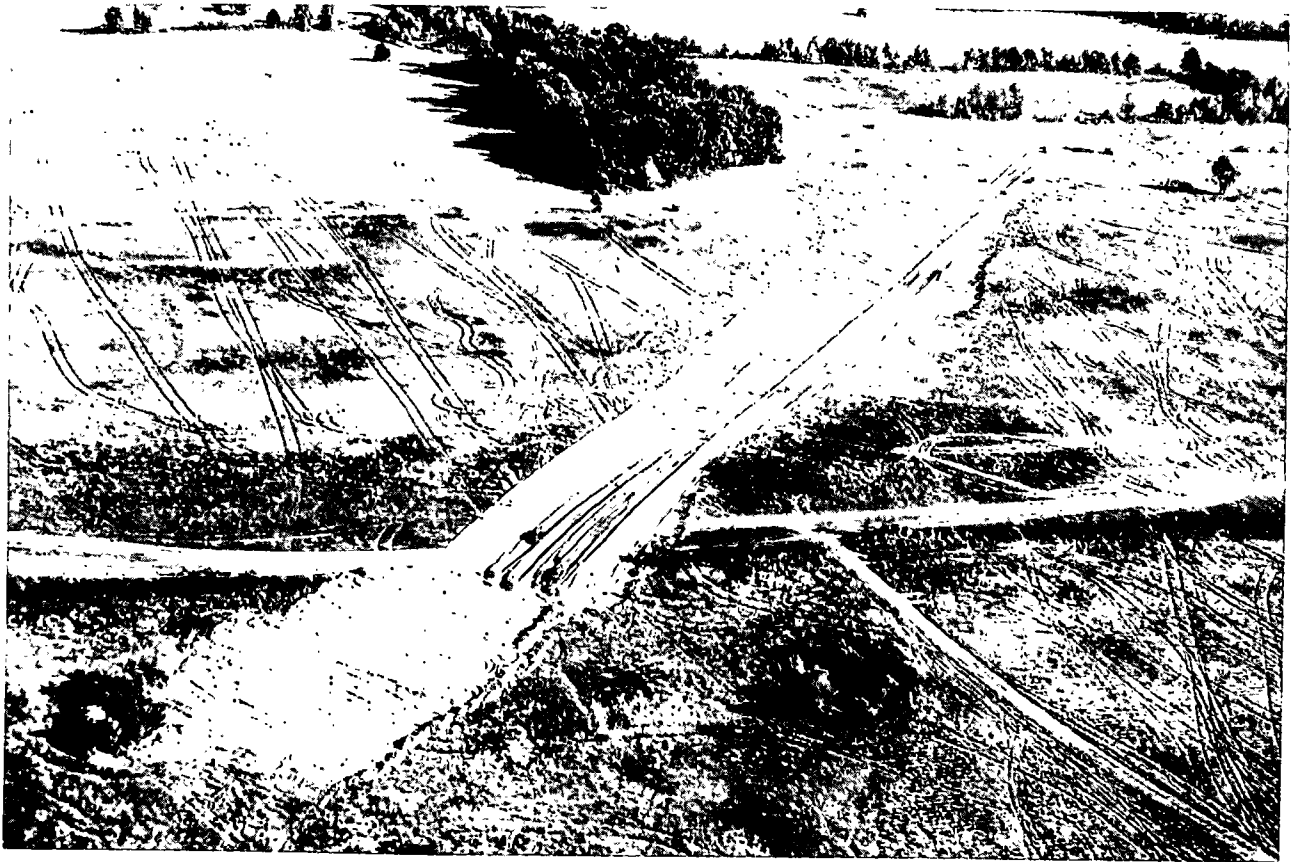


Figure 10-1. Engineers constructing a forward army airstrip.

c. The above tasks are the major missions which are assigned to army engineer combat groups. But because of their versatility and the fact that engineer units normally attempt to produce in the field much of the engineer supplies they require, units may also be assigned the following tasks:

- (1) Operation of sawmills. This may include the forestry portion of lumber production, involving selecting trees to be cut, felling trees, and moving them to the sawmills.
- (2) Operation of quarries.
- (3) Operation of sand and gravel pits.
- (4) Operation of utilities to include water, sewer, and power.
- (5) Operation of commercial plants producing cement, asphalt, and engineer supplies and equipment.

10-4. Engineer Combat Group Support in the Army Area

Normally, three to four engineer combat groups are attached to the engineer brigade in the army area. Occasionally, one or more of these army engineer groups may be further attached to a corps for offensive operations; the corps commander will then further attach the group to the engineer brigade, corps. A group is more commonly placed in direct support of corps, as discussed in the preceding paragraph, enabling the corps engineers to concentrate on work further forward. The remaining army engineer combat groups assist units within the army area by performing general engineer combat support missions. Normally, the emphasis is placed on maintenance and improvement of communication routes (fig. 10-2).

10-5. River-Crossing Operations

a. Operational Environment.

- (1) The immediate objective of the attack on a riverline is to cross quickly and establish bridgeheads to protect the crossing of the remainder of the command.
- (2) Crossing forces exploit the effects of friendly nuclear and conventional fire to seize and secure crossings before the enemy can react.
- (3) A crossing operation normally is conducted by a division as part of a corps operation. The division usually requires corps and army support such as crossing means, additional engineer units, smoke generator units, military police, and additional fire support.

b. Types of River-Crossing Operations.

- (1) A *hasty crossing* is a planned river-crossing operation characterized by speed, surprise, and the minimum loss of momentum by assault forces. It is, therefore, less vulnerable to nuclear attack than a deliberate crossing. Fire support and crossing means are made available to assault force commanders before arrival at the river. This type of crossing usually requires less non-divisional engineer combat support.
- (2) A crossing is termed *deliberate* when conducted for any of the following reasons: (a) as a resumption of the offensive at the riverline; (b) when a hasty crossing is not feasible because of the difficulty of the obstacle or the strength of enemy defenses; or (c) as a result of an unsuccessful hasty crossing. A deliberate river-crossing in the face of the enemy is frequently a corps operation. In a corps crossing, the corps commander directs tactical operations and the corps engineer directs the employment of corps engineer troops not placed under the control of the assaulting divisions. Planning for the operation begins well in advance. Based on reconnaissance, maps, and permanent record imagery, a corps tactical plan is developed prescribing

division zones of action and the priority of crossing division and corps troops. Included in the corps plan is the selection of sites for heavy fixed and floating bridges to cross corps reserves, armor, and artillery (fig. 10-3). One or more divisions are designated to make the assault crossing.

c. Group Assignments.

- (1) *Corps support.* The airborne division engineer battalion has a limited river-crossing support capability; therefore, it is restricted to spanning short gaps and aiding the assaulting elements. The armored, mechanized, and infantry division engineer battalions, however, have an organic bridge company composed of four sets of standard float bridge (M4T6 or Class 60) and assault bridge platoon (AVLB). This capability permits the construction of float bridges, rafts, trestle bridges, and fixed short spans in support of the assaulting elements. Divisional engineer battalions may also be equipped with mobile assault bridging equipment in lieu of M4T6 or Class 60 bridging. Normally, each battalion so equipped can erect 144 meters of mobile assault amphibious bridging, or four self-propelled class 60 ferries, or various combinations of bridges and ferries. Extensive crossing operations require additional support from corps or army in the form of fixed, floating, and assault bridging equipment with accompanying engineer units. In a deliberate river-crossing, therefore, one corps engineer group is normally placed in direct support of each assault division. Other engineer combat group missions in support of river-crossings involve general engineer work, such as maintenance of communication routes. Army engineers are assigned tasks in support of corps engineer groups and operate well forward into the corps areas.
- (2) *Division support.* When a group is in direct support of a division in a deliberate crossing, the group com-



Figure 10-2. Engineers improving a road.

commander meets with the division commander and his staff, especially the division engineer. The division commander develops his tactical plan, of which the engineer plan for the employment of the divisional engineer combat battalion and the engineer combat group is an essential part. Reconnaissance of crossing sites and approaches are made; and in coordination with the division engineer, the group commander aids in planning the allocation of engineer tasks and equipment.

- (3) *Role of division engineer.* The division engineer controls engineer tasks in the division area through recommendations to the division commander.

His knowledge of the procedures and capabilities of the divisional units makes him the engineer who can best recommend the location, employment, and strength of the engineer support.

d. Conduct of a River-Crossing Operation.

- (1) *Divisional engineers.* The divisional engineers have the mission of engineer support to the assault units. Initially this task will include engineer assistance to amphibious and fording vehicles entering and leaving the water, and construction of rafts and bridges. Later this task may pass entirely to attached or supporting non-divisional engineers while divisional engineers direct their support toward

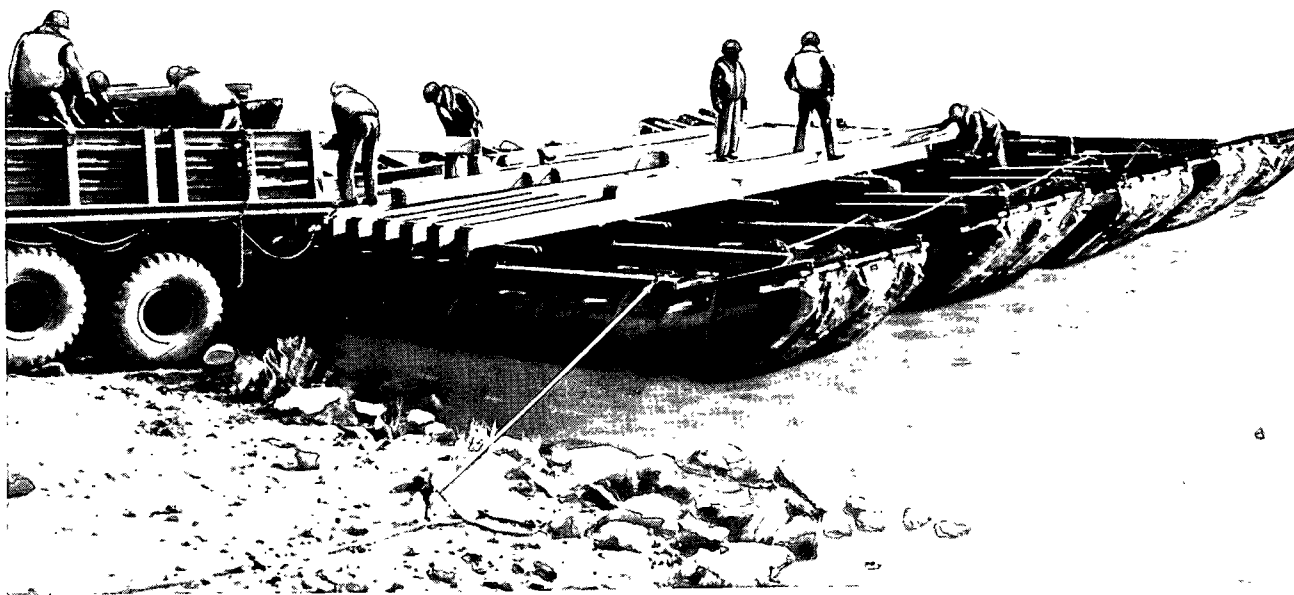


Figure 10-3. River-crossing operations, raft construction phase.

the assault elements on the far shore. In operations which require assault boats or footbridges, the divisional engineers may also participate.

- (2) *Consecutive tasks.* When possible, to insure full utilization of engineer capabilities, engineer units should be assigned consecutive tasks in the crossing.
- (3) *Unit association.* The preservation of unit integrity and unit association is particularly desirable for a river-crossing operation. The engineer company which usually supports a specific brigade is employed, if practicable, with that brigade. Additionally, the elements of the corps engineer group usually associated with a particular division are employed with that division.
- (4) *Nuclear attacks.* Commanders of units planning to cross a river must care-

fully evaluate the vulnerability to enemy nuclear attack and consider various courses of action for likely contingencies during the conduct of the operation. River-crossing operations require forces and tactics designed to survive enemy nuclear strikes and to capitalize on supporting friendly nuclear fires. Speed is necessary to exploit nuclear support and effect crossings before the enemy can react.

(5) *Engineer amphibious units.*

- (a) *General.* Engineer amphibious units support tactical forces in shore-to-shore and ship-to-shore operations by providing engineer shore and amphibious assault personnel and specialized equipment (FM 5-144). An extensive communication system and amphibious vehicles facilitate broad front crossings in the

face of enemy nuclear capabilities. Troop composition and equipment is dependent on tactical and logistical considerations. Officers assigned to engineer amphibious units advise and assist landing force commanders in planning and preparatory activities; prepare and coordinate the beach development plans; and command shore parties. A type organization of shore parties for river-crossings is described in FM 31-60.

- (b) *Vehicles.* Engineer amphibious units contain armored, amphibious tracked landing vehicles. These vehicles are used to move supplies, weapons, personnel, and equipment across a water barrier. After landing, they provide inland mobility to the assault elements.

e. Joint Operations. The overall commander, in planning joint amphibious operations, considers all available means of crossing the water barrier including air, ground, or water vehicles and deep water fording techniques.

10-6. Assault on a Fortified Area

a. Principles Employed. The principles employed in assaulting a fortified position are similar to those in the offense with the exception that the assault is more complex because of barriers and obstacles defended by fire and by the natural advantages of defensive terrain chosen by the enemy. These difficulties are overcome by combat superiority, thorough training and preparation, special troops and equipment, and by an attack initially on a narrow front (FM 31-50).

b. Phases of the Assault.

- (1) Four phases characterize the assault on a fortified area. They are:
 - (a) Reducing the hostile outpost system and developing the attack.
 - (b) Breaking through the enemy's forward edge of the battle area (FEBA).
 - (c) Extending the gap laterally by isolating and reducing flank emplacements.
 - (d) Moving mobile reserves through

the gap to complete the reduction of remaining fortifications and the continuance of the attack.

- (2) These phases are not always clearly defined, and often they overlap.
- (3) It is paramount that each success be immediately exploited. Following any breakthrough, the attack is pressed forward; isolated pockets of resistance are left to reserve echelons.

c. Engineer Missions.

- (1) During the attack, the principal mission of the engineer is to assist in breaching the outer and larger obstacles which protect the main fortified position. Reduction of enemy resistance within emplacements and the breaching of minor obstacles are assigned to specially organized and equipped assault teams which lead the attack.
- (2) Following the breakthrough of a fortified line, the engineers improve and maintain routes through the gap and demolish emplacements as directed.

d. Disposition of Engineer Elements.

- (1) To insure close coordination, engineer and other assault elements operate as a team particularly in the initial phases of the assault. For this reason engineer elements are attached to the assaulting teams. Normally, divisional engineers cannot furnish all the necessary engineer support needed in the assault. Therefore, the corps engineers may be called upon for additional support. Attachment will ordinarily cease when the main obstacles and positions have been breached and passed.
- (2) Except for elements attached for the initial phases of the assault, corps engineer combat battalions function in direct support of divisional engineers. In this capacity, gaps through obstacles are widened, routes are improved and maintained, and minefields are cleared. Corps engineers work as far forward as possible permitting divisional engineers to accompany the assault elements.

e. Reconnaissance and Planning.

- (1) In preparation for the assault, close study is given to the obstacles and minefields which will be encountered and to the terrain and routes forward through the fortified areas. Information is collected by ground reconnaissance, supplemented by aerial photographs and other sources. Details which cannot be determined by distant visual observation may be obtained by reconnaissance patrols. The intelligence effort is aimed at uncovering routes through obstacles which will be easily cleared and subject to the least fire. To achieve good results, reconnaissance must be carefully planned and coordinated; reconnaissance parties receive explicit instructions on the conduct of each mission.
- (2) The strength, equipment, and organization of engineer clearing parties are based on all information available.

A clearing party is usually divided into smaller task groups, for example:

- (a) A leading group to clear antipersonnel mines.
- (b) A group to breach the obstacles.
- (c) A group to mark the gap and the routes between gaps in successive obstacles.
- (d) A group to furnish replacements for casualties or reinforcement.

f. Training. Thorough training and rehearsals are desirable before an assault on a fortified area. Training in the techniques of passing obstacles is stressed. Assault teams composed of infantry, engineer, armor, and artillery elements working in close coordination are formed early in the preparatory phase. These teams rehearse together on replicas of fortifications to be encountered which are located on terrain similar to that of the area of attack. Sand tables and similar training devices are useful if full-scale reproduction is not possible.

Section II. DEFENSIVE OPERATIONS

10-7. Purpose of Defense

In the defense, units prevent, resist, repulse, or destroy an enemy attack. The purpose of the defense is to gain time pending the development of more favorable conditions for undertaking the offensive; to economize forces in one area and thus concentrate superior forces for decisive offensive action elsewhere; to destroy or trap a hostile force; to reduce the enemy capacity for offensive action; or to deny an enemy entry into an area.

10-8. Doctrine of Defense

a. The doctrine of defense prescribes the use of security forces to provide early warning to detect, delay, deceive, and disorganize the enemy; defense forces to organize the forward defense area to repel the attacker and develop the situation; and a reserve force to eject or destroy the attacker by offensive action. This doctrine also capitalizes on mobility, firepower, and limited offensive action to retain the initiative; denies the attacker his decisive objectives without the defender becoming fixed and destroyed; and destroys the enemy by fire and

maneuver. The nature of the operation demands adequate space for maneuver and a high degree of mobility. The employment of nuclear weapons provides the defender with an even wider choice of tactics.

b. The planning, organization, and conduct of the defense are based on the following considerations:

- (1) Proper use of the terrain.
- (2) Security.
- (3) All-round defense.
- (4) Defense in depth.
- (5) Responsiveness.
- (6) Dispersion.
- (7) Maximum use of offensive action.
- (8) Integration and coordination of defensive measures.
- (9) Time available.

10-9. Basic Types of Defense

There are two basic types of defense, the *mobile* defense and the *area* defense.

a. The *mobile* defense employs a combination of offensive, defensive, and delaying actions

with the ultimate success of the defense depending upon offensive action. The primary objective of the mobile defense is the destruction of the attacking enemy force. In the mobile defense, minimum forces are deployed as fixing forces in the forward defensive area to detect, disorganize, and delay the attacking enemy and to provide time and space for action of the striking force. The bulk of the combat power of the command is deployed as a counterattack force which employs the principles of offensive combat to destroy the enemy at the most favorable time and place.

b. In the *area* defense emphasis is placed on retention of specific terrain and offensive and defensive actions are directed at stopping the enemy forward of the forward defensive area or ejecting him if he penetrates this area. The bulk of the combat power of the command is committed to defense of the forward defensive area. Reserves are employed to add depth to the defense, to block or destroy enemy penetrations, to counterattack and restore the defensive position, or to reinforce threatened forces.

c. In many instances, the defense conducted will be a composite of both types.

10-10. Defensive Employment of Non-divisional Engineer Units

a. Engineer operations in the defense consist mainly of supporting other troops in organizing the ground. This is a process of strengthening positions by clearing fields of fire, entrenching, constructing weapons emplacements, shelters, and barrier construction, which includes the installation of wire, minefields, and other obstacles (FM's 5-15, 5-25, and 31-10). Combat troops are, in general, responsible for organization of the ground and construction of defensive works in their assigned area. Nondivisional combat engineers provide technical advice and assistance. Engineers furnish plans, equipment, supervision, supplies, and technical assistance as needed.

b. Divisional engineers generally receive additional assistance from corps engineers to construct extensive fortifications or barrier systems. Support is extended in the same manner as in the offense. Some of the tasks on which the corps groups may be employed are

roadwork and operating water points in the rear areas; installation of fixed or floating bridges; earth removal; preparation of flank or blocking positions; and participation in installing designated portions of the barrier system.

c. The covering force for a corps defensive position is designated by the corps commander. The covering force usually has organic engineers, but these may be supplemented by elements from the corps engineer brigade. Corps engineers will be attached to the force since the distance is too great for effective control by the engineer group commander. The non-divisional engineer elements usually operate under direction of the staff engineer of the covering force. Operations of the covering force are generally of the same nature as those in the main battle area but are less extensive. A special concern of the covering force is that routes of withdrawal must permit orderly retirement without delay. The preparation of roads and bridges forward of the general outpost line for supply of the covering force and for its eventual withdrawal is the responsibility of the covering force engineers and much or all of this work will be assigned to the attached engineer element.

d. Preparation of Rear Area Defensive Positions.

- (1) *Assignments.* Corps and army engineer groups may be called upon to prepare defensive positions and barriers in rear areas. These are positions to which forward troops may fall back.
 - (a) A fully prepared position requires a great deal of hand labor. The group commander should estimate his requirements and request the assignment of other troops and civilian labor. The reinforcing labor is directed and supervised by engineer troops.
 - (b) For the preparation of a large defensive position, battalion work assignments should be made on an area basis.
- (2) *Priority of work.* The group commander must keep in mind that troops may have to occupy a position before

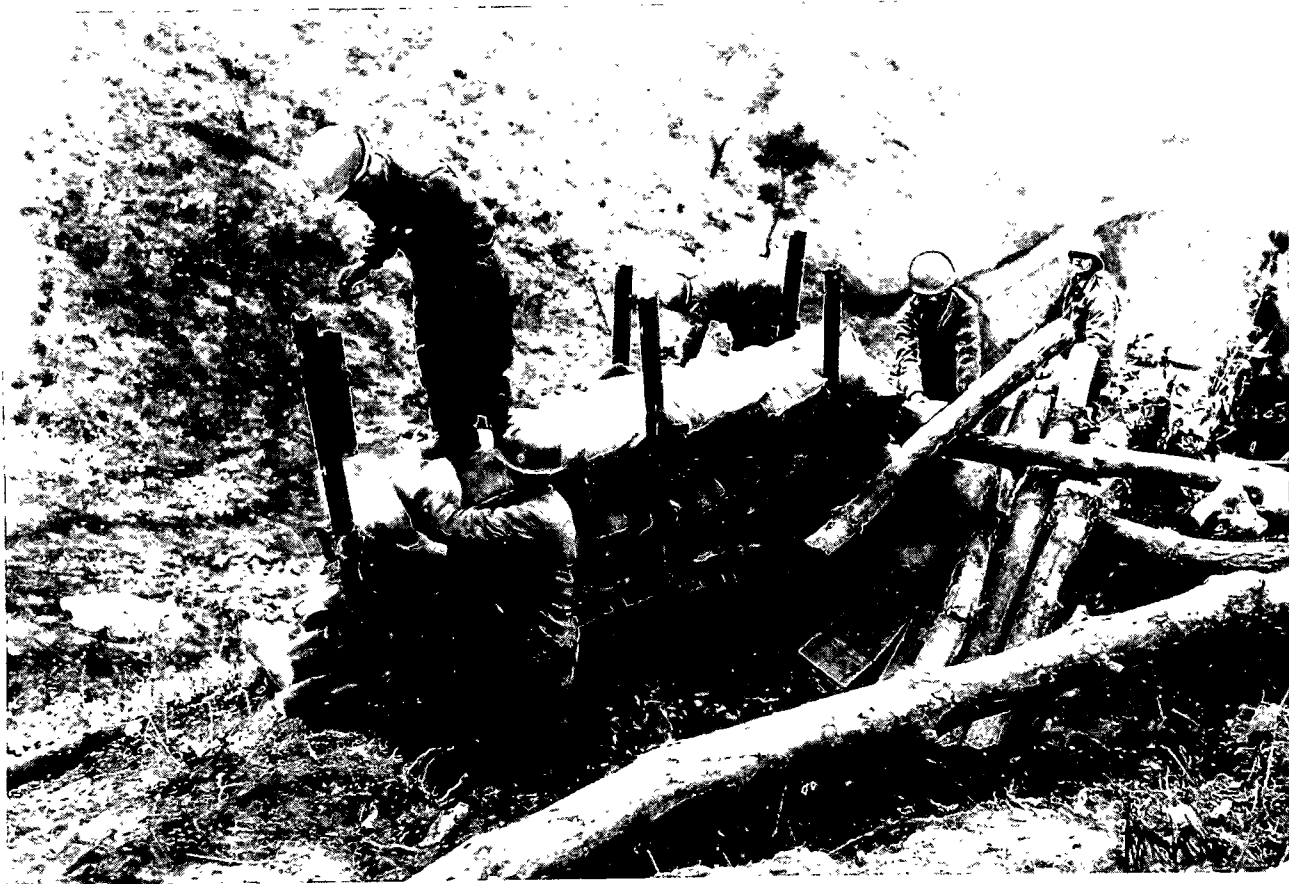


Figure 10-4. Crew-served weapons emplacement being constructed by engineers.

it is completed. For this reason, the work which will be most valuable to the occupying troops is undertaken first. The normal priority of work is as given below but it should be understood that, whenever possible, work in two or more of these categories will be underway concurrently.

- (a) Constructing positions for nuclear delivery means.
- (b) Clearing fields of fire and objects that restrict observation.
- (c) Preparing barrier traces by laying minefields and preparing other obstacles, such as roadblocks and bridges, for demolition.
- (d) Preparing positions for nonnuclear artillery.
- (e) Preparing individual shelters and

crew-served weapons emplacements (fig. 10-4).

- (f) Preparing secondary demolitions and obstacles other than minefields (fig. 10-5).
 - (g) Improving routes for supply, evacuation, and movement of reserves.
- (3) *Layout of position.* The general nature of the position will be prescribed by the corps or army commander. If the identity of units designated to occupy the position is available, their commander is requested to furnish liaison personnel to the engineer combat group. In cooperation with these liaison officers, plans are further developed. In cases where the identity of occupying combat units are not known, army or corps staff officers



Figure 10-5. Abatis created by nondivisional combat engineers.

may be assigned to assist in the preparation of the position.

10-11. Barrier Plan

a. Definition. A barrier system is a coordinated series of natural or artificial obstacles, or both, designed to stop, delay, direct, restrict, or canalize the enemy and to impose additional losses in personnel, time, and equipment on the attacking force. To be effective, it is covered by fire, organized in depth, and has flank protection.

b. Purpose. Barriers contribute materially to the purpose of the defense; that is, to gain time and to economize forces. Natural terrain obstacles are supplemented by effective barrier systems including minefields, atomic demolition munitions, persistent effect chemical agents, and other artificial obstacles. The barrier plan also includes antitank obstacles (FM

31-10). Barriers may be employed in the defense to:

- (1) Delay enemy advance toward the front or flanks.
- (2) Delay or limit movement of penetrating or enveloping forces.
- (3) Canalize enemy movement into areas where he can be defeated, destroyed, or contained.
- (4) Separate enemy armor from infantry.
- (5) Provide for economy of force.

c. Responsibility and Employment of Nondivisional Engineer Combat Units.

- (1) All organizations are responsible for construction of that portion of a barrier falling within their area of responsibility. Engineers support units by technical advice, construction of specified barriers (fig. 10-6), and

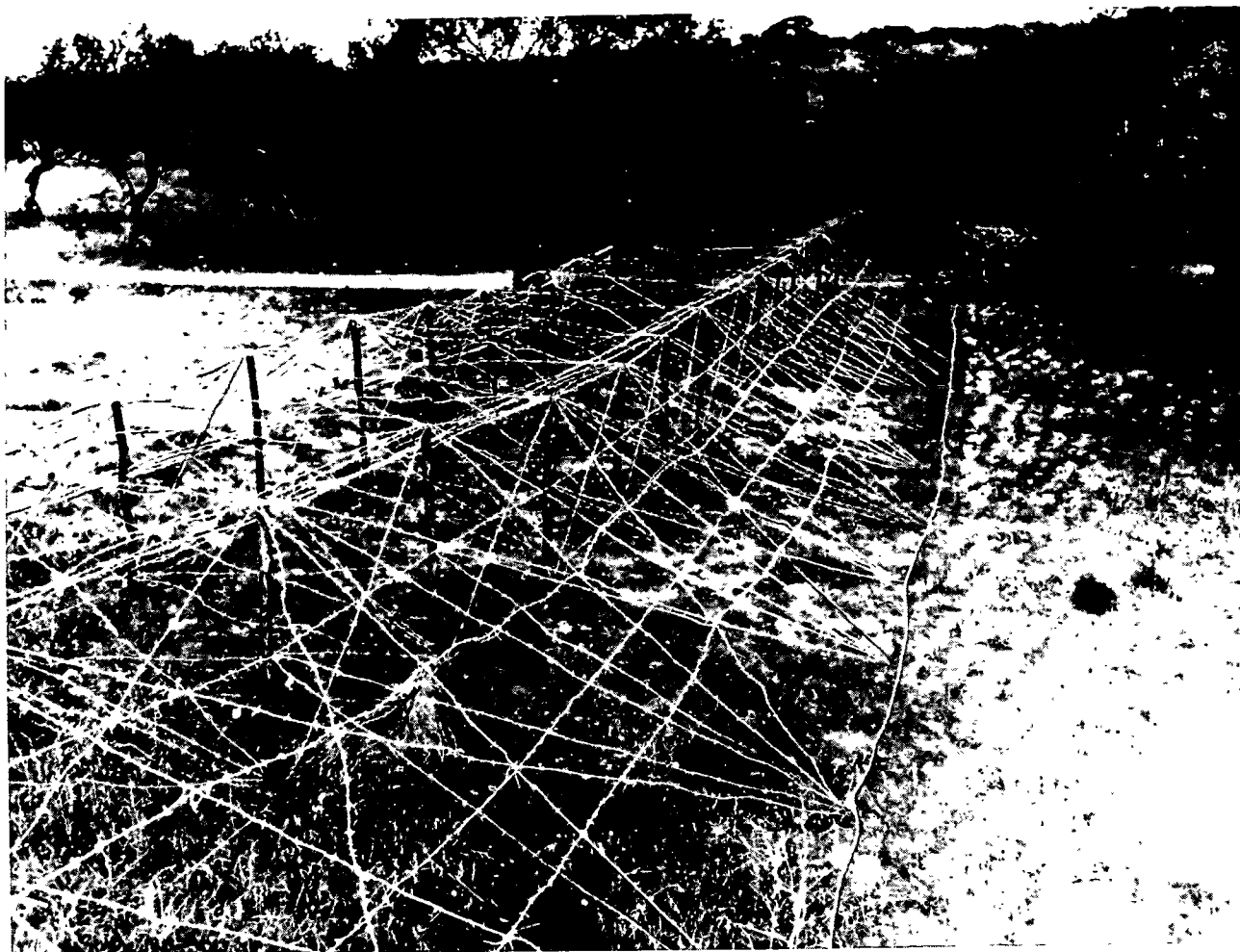


Figure 10-6. Wire obstacles, part of a barrier.

preparation and execution of specified demolitions.

- (2) Engineer units usually are assigned responsibility for the siting and construction of obstacles which:
 - (a) Require special skills and equipment.
 - (b) Protect exposed flanks or rear.
 - (c) Benefit the command as a whole.
 - (d) Must be prepared before the arrival of the troops who are to occupy the position.
 - (e) Lie outside the area of responsibility of a particular unit.
- (3) Nondivisional engineer units must be constantly prepared to fulfill the responsibilities listed above either in the division or rear areas. In the divi-

sion area, all work will be coordinated with the division commander, usually through the division engineer. Work within the corps and army areas will be supervised by the respective engineer brigade commander.

10-12. Retrograde Movements

Also considered in defensive operations are retrograde movements which are further classified as delaying actions, withdrawals, and retirements.

a. Delaying Action. In a delaying action, punishment is inflicted on the enemy without all or part of the friendly forces being decisively engaged. Space is traded for time.

b. Withdrawal. In a withdrawal, friendly forces disengage from the enemy in order to initiate some other action.

c. Retirement. A retirement is an operation in which a force not in contact moves away from the enemy.

10-13. Nondivisional Engineer Support in Retrograde Movements

a. In retrograde movements the principal engineer duty is to keep routes of withdrawal open. These routes are those previously in use, and often they will require only normal maintenance. However, if capable, the enemy will damage or destroy bridges and other critical points, such as road junctions. Prompt repair of these facilities may prove to be a major task, and often, additional or alternate routes must be constructed. Corps engineers destroy installations, supplies, and structures which will not be needed by retiring divisional troops if such destruction is included in the corps denial plan. Bridges and culverts along the route of withdrawal are prepared for demolition. A small party is left at each point which has been prepared. As each party is relieved by the division engineers, corps engineers rejoin their unit. Minefields are laid, and other obstacles are constructed. Divisional engineers close the gaps when all troops have passed through. Designated delaying positions are prepared with as much organization of the ground as time permits. All possible work is accomplished before the arrival of the divisional troops. The preparation and execution of demolitions and the creation of minefields is on order and in accordance with demolition plans of the corps commander (FM 5-25).

b. To support the corps engineers in retrograde movements, army nondivisional engineer units maintain roads and bridges, prepare and execute demolitions, prepare delaying positions, and establish minefields and other obstacles. Both corps and army nondivisional engineer units may be called to assist in the movement of corps and army troops and installations.

10-14. Denial Operations

a. Denial operations deny the enemy the use of material objects and areas of terrain which would otherwise be useful to him. They are accomplished by removal, damage, or total destruction. Damage and destruction are most commonly accomplished by fire, flooding or

sinking, mechanical force, explosives, projectiles, and contamination. These operations are not limited to engineers. Other troops can burn supplies and wooden structures, run or drop equipment and supplies into deep water, remove critical parts from equipment, break up material, destroy or damage installations by weapons fire, and by other means execute denial operations on a large scale. Nondivisional combat engineers use all means but are especially concerned with the more technical aspect of such operations; examples are the use of demolitions on a large scale and the flooding of important areas. Engineers can be called upon for destruction of supplies or logistical installations during a denial operation. Engineer troops should be familiar with various ways of destroying supplies and equipment.

b. It is important that the necessity for, and the command control over, denial operations be realized. The extent of denial operations may vary from inflicting only minor damage to utter destruction by the withdrawing force. The degree and the detail of destruction are dependent upon future operational plans and political considerations. For these reasons, the proper control of denial operations is a command responsibility. Each commander prescribes denial operations in as much detail as possible and delegates to his subordinates general authority under specific directives. Any denial operation is executed under specific authority of an officer to whom such authority has been delegated. For more detailed information see FM 5-25 and FM 31-10.

10-15. Rear Area Security

a. In a rear area, an engineer combat group may be the only organization, or at least, the largest and best trained organization capable of engaging in ground combat. The engineer group, therefore, will often be assigned a rear area security mission requiring the use of troops of other services, including those from miscellaneous installations, such as hospitals, depots, and shops. Orders to the group commander assigning him this mission will give him authority to integrate other troops into his defense plan and also give him command authority during emergencies.

b. The extent of the area, the composition of the troops within the area, accomplishment of

the service mission, communications available, and the nature and probability of attack will vary; therefore, the number and disposition of troops required on security alert will vary accordingly. The threat may be only minor activity by irregular forces or it may be an airborne or night infiltration attack in force. The danger of air attack and chemical, biological, or radiological attack is often present. A full-scale defense plan might include an entire non-divisional engineer combat battalion on outpost duty. Other troops are incorporated into the defense plan according to their capabilities, each unit receiving a definite mission. Service troops operating installations in the area are usually not assigned a defense sector; but, if necessary, they may be given one which can be manned after the alarm is sounded. Unless required on the defense perimeter, units operating installations are normally charged only with providing local security of their own installations and with static defense thereof. As in all security systems, an alarm and warning system and good communications are im-

portant. At night, special security precautions are required. Improvised alarms provide early warning against attack. Dispersion, either within an installation or in associated installations under common control, increases the danger of enemy infiltration and attack. A compromise between meeting the threat of enemy ground action and the demand for dispersion as passive defense against enemy conventional air and artillery or nuclear attack must be devised. Working parties, while moving to or from a work or bivouac site, are constantly alert for ambushes or boobytraps. Whenever possible, unfinished construction jobs should be guarded when work parties are not on the site. In the field, as elsewhere, security measures are kept in balance with the basic mission. Individuals are indoctrinated with habits of alertness and caution. Weapons are kept readily available at all times. Individuals, and the command as a whole, are trained to react in the event of enemy airborne attack, infiltration, action by irregular forces, or attack from other sources.

Section III. COUNTERINSURGENCY OPERATIONS

10-16. Counterinsurgency Operations

Engineer combat units, being mobile and air transportable, may be used to support counterinsurgency operations. While such support will generally be assistance in the form of planning, organizing, and supervising light construction projects, engineer combat units may, on occa-

sion, be required to provide training and advice to host country engineer forces. Engineer units usually will maintain their organizational integrity. They possess the capability of being organized into special task groups of from platoon to company size. For a general discussion of engineer units in counterinsurgency operations, see FM 31-22.

Section IV. AIRHEAD OPERATIONS

10-17. Initial Operations

a. During the assault phase of an airborne operation, an essential task of the organic airborne division engineer battalion is to clear air landing facilities for assault aircraft. Since initially, the airborne engineer battalion will be using equipment of limited capability, it should be augmented by elements of the light equipment company, airborne, which can be delivered by parachute or assault type aircraft (fig. 10-7).

b. In long-duration airborne operations, when landing facilities have been developed so that

aircraft can be landed on a continuing basis, the remainder of the engineer light equipment company, airborne, and other engineer combat support elements are airlifted to the airhead.

10-18. Subsequent Operations

Elements of the airborne division engineer battalion are released from work on the landing facilities by other engineer combat support elements as soon as possible. As early as possible, the engineer group will be airlifted to the airhead and will assume responsibility for construction of the landing facilities.

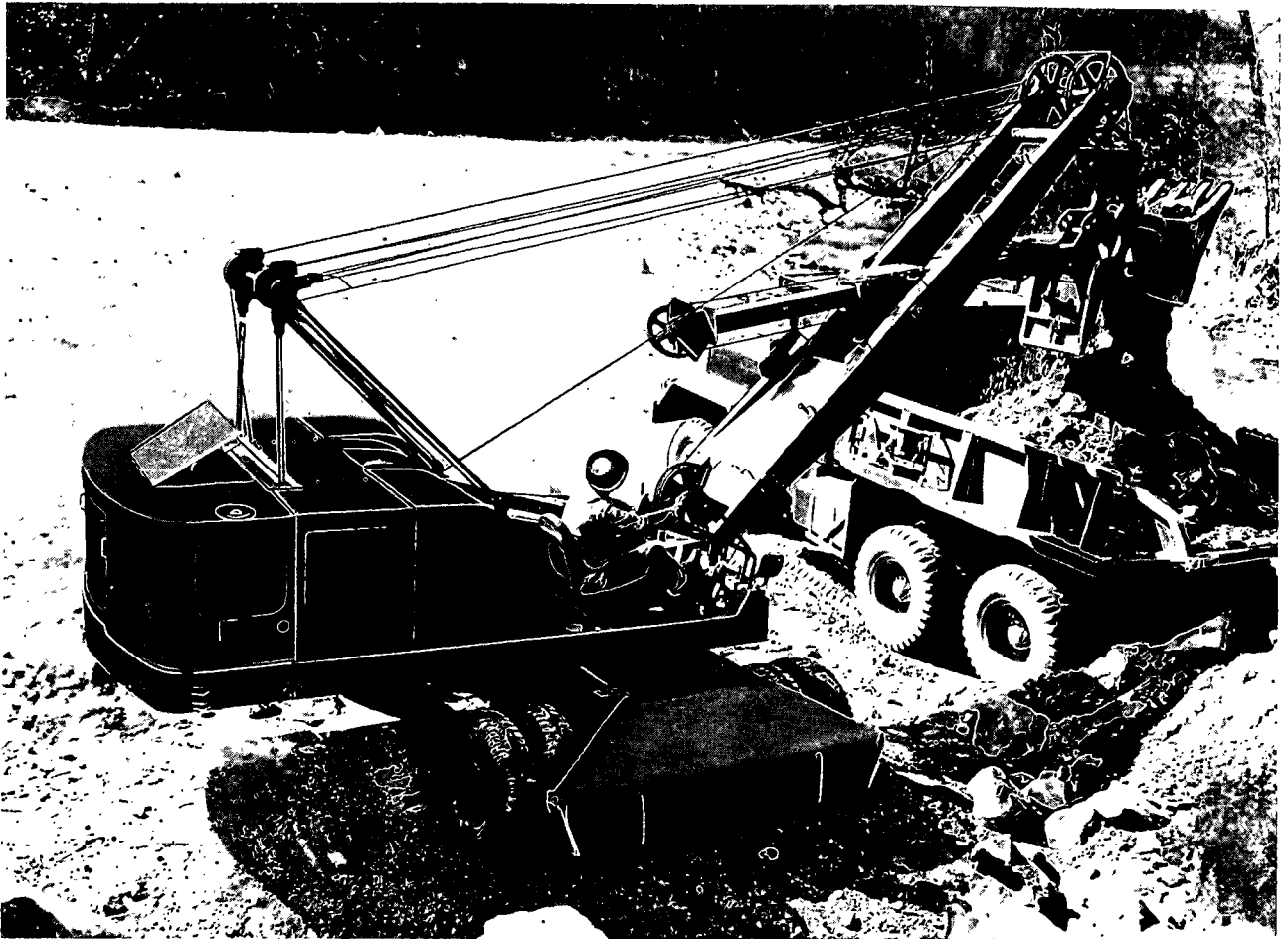


Figure 10-7. Airborne crane-shovel in operation.

Section V. SPECIAL ENVIRONMENTAL FACTORS

10-19. Types of Areas

Operations in desert areas, northern areas, mountain regions, jungles, urban areas, and forests require special considerations; and engineer techniques must be adapted to meet the peculiarities of the environment. Each special

environmental condition will require individual study by the engineer commander and staff.

10-20. References

For specific discussions on special environments, see FM 31-25, FM 31-30, FM 31-50, FM 31-71, and FM 31-72.

Section VI. GROUND COMBAT

10-21. General

a. Engineer combat units are trained to fight as infantry. In addition to fighting in small units to provide security while in bivouac, on the march, or at work, the nondivisional engineer combat units may be committed in a

ground combat role. Engineers usually are committed when the need for fighting strength is more important to the accomplishment of the mission than normal engineer support.

b. The basic training of combat engineers parallels that of infantry; but engineers re-

ceive considerably less tactical training and experience, and their combat capabilities are accordingly reduced. The nondivisional engineer combat unit, compared with the infantry unit, is still further limited by its strength, lack of close support weapons, communications, and fewer medical personnel. To compensate for its lesser firepower, the engineer unit is assigned a smaller frontage than an infantry unit and appropriate provisions are made for indirect fire support and forward observers.

c. Some of the typical situations in which a commander may commit engineers to ground combat are:

- (1) An over-extended defensive front.
- (2) A sudden enemy penetration, envelopment, or turning movement.
- (3) An enemy airdrop or an organized attack by irregular forces.
- (4) The relief or reinforcement of a combat force.
- (5) As part of a covering force.

10-22. Types of Missions

The type of mission that an engineer combat unit will receive in ground combat is limited by the type of unit, assigned weapons, and personnel. Primarily, there are two types of roles—*offense* and *defense*.

a. *Offensive-Type Mission.* Very seldom do engineer units at corps and army level receive a mission in the offense. However, a nondivisional engineer combat unit might be given the mission of assisting combat forces in the seizure of a large objective or be required to destroy a bypassed enemy stronghold. Offensive commitments usually are rare, but engineer personnel must be properly trained in all phases of basic infantry tactics and be prepared to assume a mission on the offense when required.

b. *Defensive-Type Mission.* Of the two types of missions, the defensive is the one more within the capabilities of engineer combat units. It is also the mission most frequently assigned the engineer unit. Time is needed for an engineer unit to adequately prepare for ground combat. Proper support (such as artillery fires) must be provided and coordinated. Nonessential personnel and items of equipment are moved to an area which provides protection from enemy interference. If it becomes necessary for

the engineer commander to immediately engage the enemy, he commits his unit in such a way as to initially stop or slow the enemy advance. Once accomplished, the unit is prepared for coordinated ground combat. When ample warning time is available, the engineer commander prepares his unit for combat in much the same way as other combat force commanders. He makes an estimate of the situation; and after coordinating with adjacent units, fire support, and other supporting units, he issues an operations order.

10-23. Preparation for Combat

a. Group.

(1) The group, less its separate companies, should be assigned a portion of a line where a coordinated attack, supported by armor, artillery, and heavy weapons, is unlikely. Tactical employment is similar to that for comparable infantry units but modified to fit the organization and weapons of the engineers. The group may be employed as a separate force in an infantry-type role; for example, to occupy and defend corps blocking positions. It should be attached to a division or task force if it is to be employed as infantry in the area of the division or task force.

(2) The group is organized into a combat (forward) and rear echelon. The rear echelon includes the separate companies of the group and a group equipment pool of that equipment not required in combat. Personnel are provided from all units to operate the equipment and provide security for the equipment pool.

b. Battalions.

(1) For employment in ground combat, the elements of the battalions are organized to provide command, control, maneuver, fire support, and combat service support elements. Personnel for the evacuation and security of equipment not required in the combat role are also designated. A standing operating procedure (SOP) for combat organization is established and made the basis of training.

- (2) The battalion and its elements are divided for ground combat into combat (forward) and rear echelons.
 - (a) The combat echelon consists of those who actually engage in combat and personnel who provide command, control, and combat service support. Light vehicles are included in the combat echelon for communication, supply, and tactical vehicular movement.
 - (b) The rear echelon consists of the personnel and equipment not needed for combat, including equipment, trucks, heavy vehicles, and powered engineer equipment. The number of personnel assigned is the minimum necessary to maintain the mobility of the rear echelon, provide for its

local security, and perform essential administrative and maintenance functions. The rear echelon is commanded by the senior officer present, usually the commanding officer of the headquarters and headquarters company. The rear echelon is located in the rear normally beyond the range of enemy light artillery.

- (3) The company or platoon, when engaged in independent ground combat, organizes its combat elements as when operating in a combat role with the battalion. The rear echelon is organized according to the principles outlined in the above paragraph but is located at a lesser distance behind the lines.

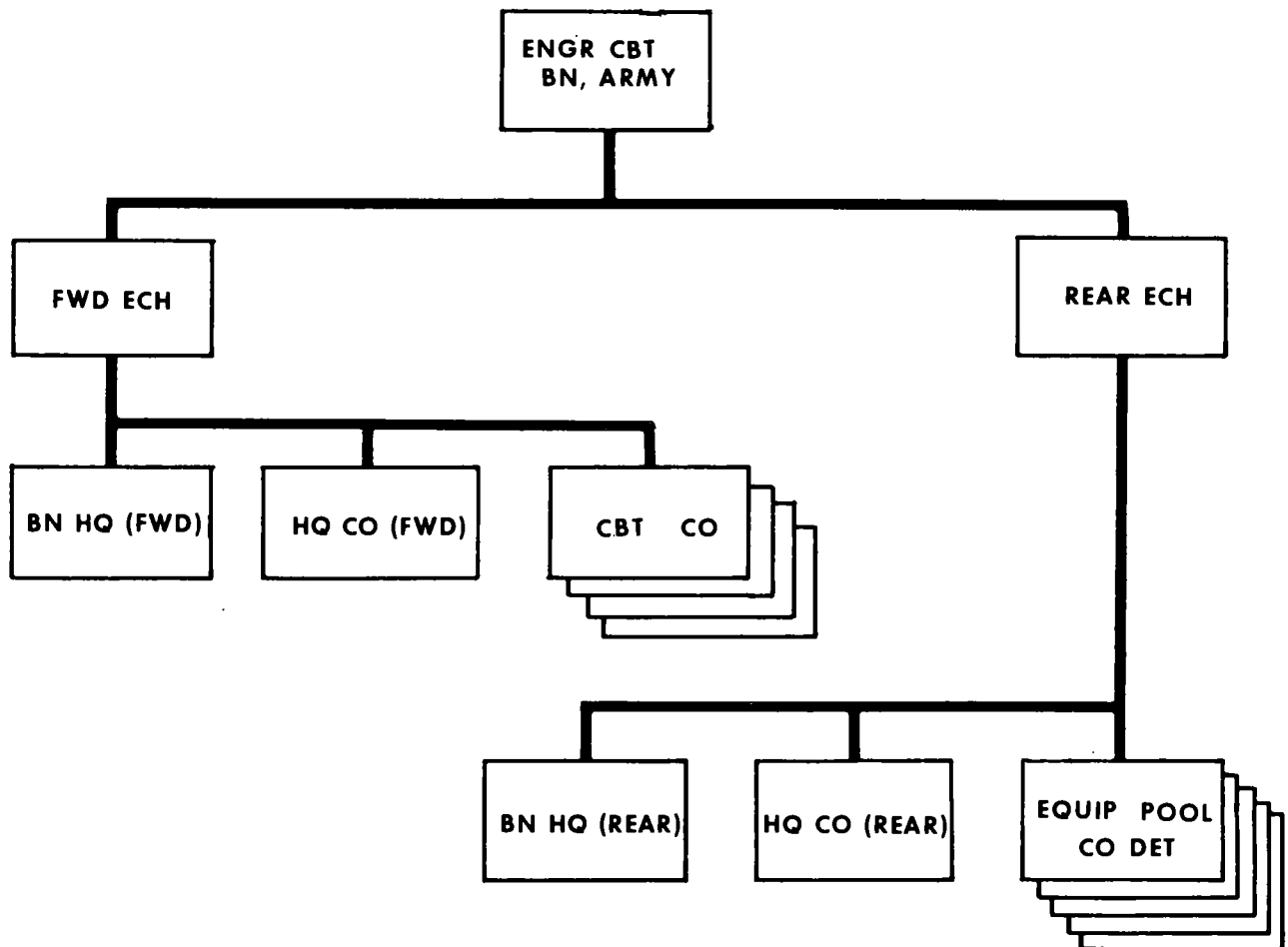


Figure 10-8. Suggested internal changes of a nondivisional engineer combat battalion, army, for an infantry-type combat role.

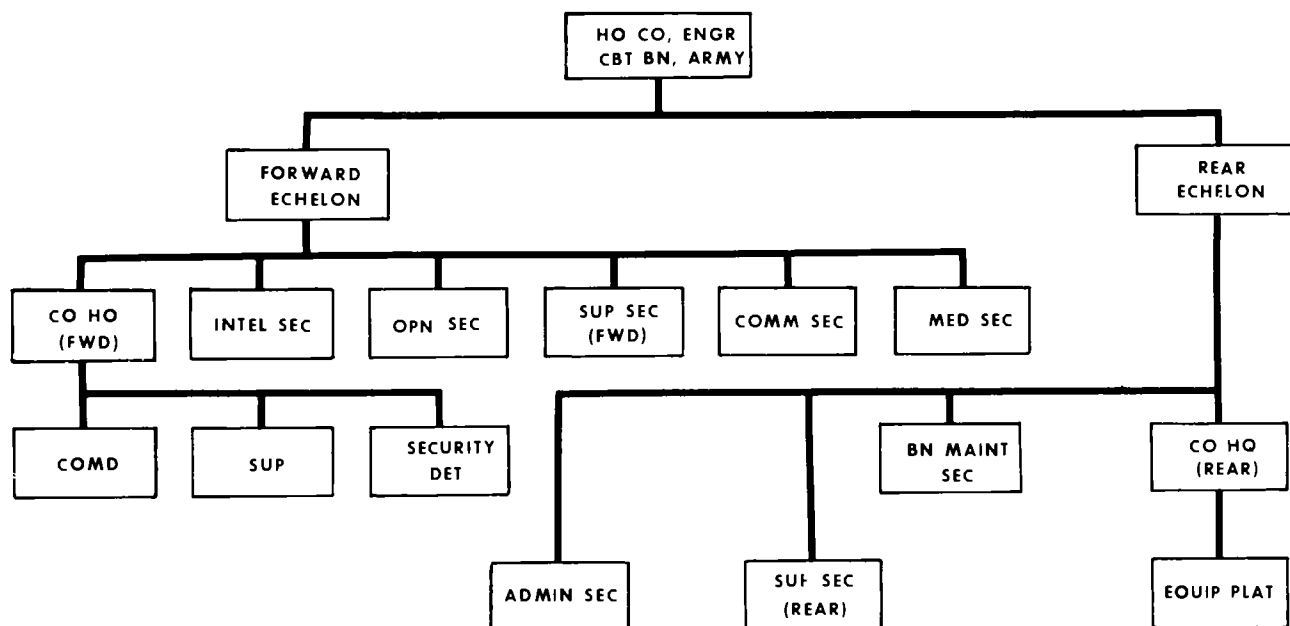


Figure 10-9. Suggested internal changes of headquarters company, engineer combat battalion, army, for an infantry-type combat role.

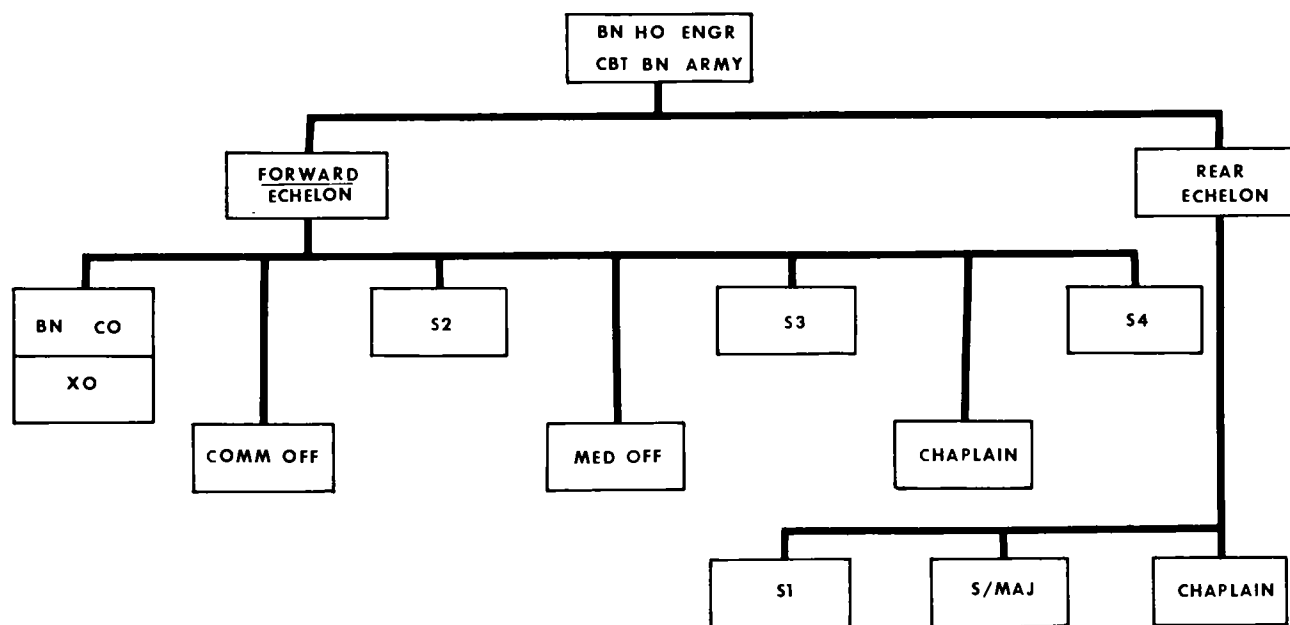


Figure 10-10. Suggested internal changes of battalion headquarters, engineer combat battalion, army, for an infantry-type combat role.

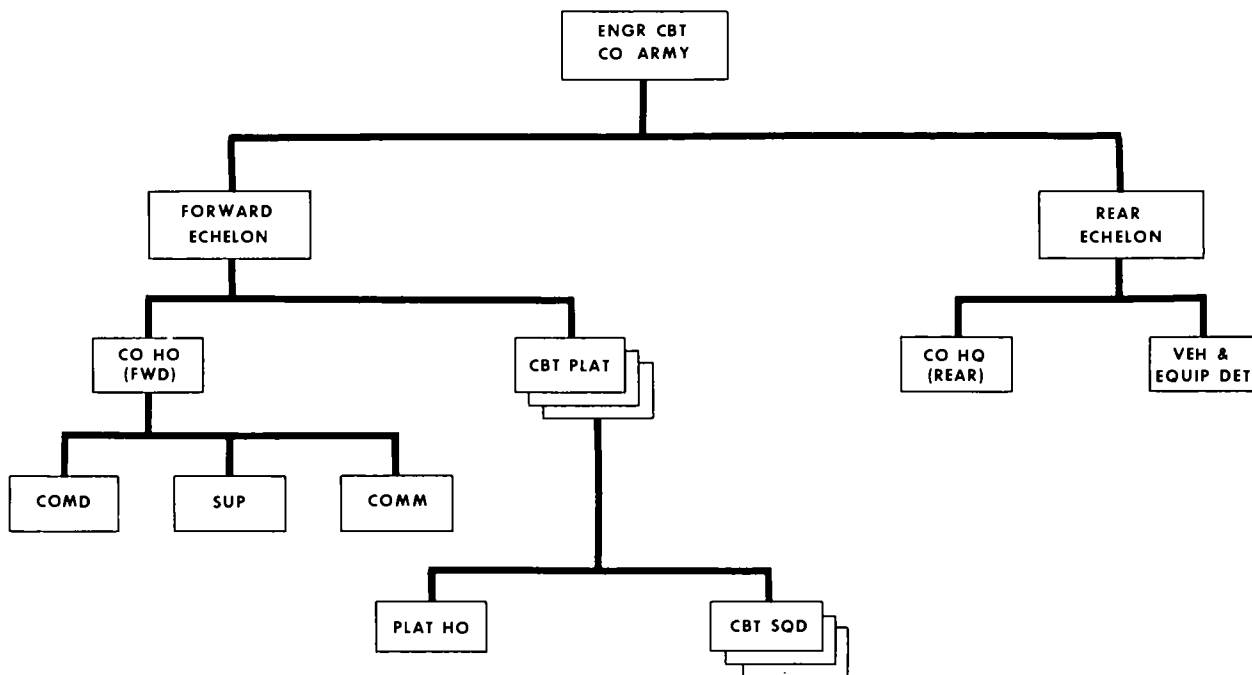


Figure 10-11. Suggested internal changes of an engineer combat company, army, for an infantry-type combat role.

- (4) When the battalion is committed to combat, engineer operations are usually suspended. In some situations, however, certain work, such as operation of water points, engineer reconnaissance, and emergency maintenance of roads may be carried on by personnel of the rear echelon. Occasionally an entire combat company may be withheld for the execution of engineer missions.
- (5) Because of the variety of circum-

stances which may affect the organization of an engineer battalion for combat, it is impractical to prescribe an organizational plan applicable to all combat battalions. Each commander, taking into consideration the characteristics of his battalion, prepares a definite combat plan as part of the battalion SOP. Figures 10-8, 10-9, 10-10, and 10-11 are offered as guides by which the commander may prepare his battalion for ground combat.

CHAPTER 11

INTELLIGENCE, RECONNAISSANCE, AND SECURITY

Section I. INTELLIGENCE AND RECONNAISSANCE

11-1. Types of Intelligence

The planning and conduct of operations by a commander depend to a great extent upon reliable intelligence. The information affecting the nondivisional combat engineer organization is of two types. First, for the security of engineer operations or for repelling hostile attacks, intelligence of the tactical dispositions, strength, and capabilities of the enemy and of friendly troops is essential; this is known as combat intelligence (FM 30-5 and FM 100-5). Second, engineer operations require a great deal of technical data regarding terrain, routes of communication, weather, structures, engineer materials and equipment, and water sources within the area of operations. This physical and technical information bearing on engineer operations is known as *engineer information*; when it has been evaluated as to reliability and interpreted to determine its significance, it is known as *engineer intelligence* (FM 5-30). The process of gathering engineer information in the field is known as *engineer reconnaissance* (FM 5-30, FM 5-36, and FM 30-10).

11-2. Responsibility for Intelligence

Each commander is responsible for the collection of information within his command and for its dissemination to subordinate units, higher headquarters, and adjacent units. This continuous responsibility applies to all information which may be useful to other units as well as information especially useful to his own unit. Although from time to time a commander will be directed to obtain certain specific information, he is never relieved from the duty of gathering and reporting all pertinent information. These considerations necessitate special training at all levels of command to include the individual soldier. Intelligence training includes instruction in the nature of required

information and the mechanics of collection and reporting; it is conducted so as to indoctrinate each individual with his responsibility to collect and report information without specific instructions.

11-3. Sources of Engineer Information

a. The nondivisional engineer unit will gain a great deal of information generally applicable, and sometimes specifically applicable, to engineer interests. Such information is derived from many sources and will be reported to the organization in the form of intelligence reports, maps, photographs, and special communications from higher headquarters. In addition, the organization may and should request specific information as needed when the procurement of that information is beyond the organization's capabilities. The most frequent need for such information occurs in connection with planning for operations in an area still occupied by the enemy. In this connection, it should be remembered that higher levels of command have many resources for gathering information which are beyond the engineer's capability. A commander should never assume that information is unobtainable merely because it is not automatically furnished.

b. Besides information received through command channels, much valuable information is gained by liaison with neighboring units. Such liaison generally is established between the intelligence staff sections of the units concerned.

c. A large portion of the information used by the brigade and group headquarters is that provided by attached units. Intelligence is an important part of the unit effort; its value should not be underestimated.

11-4. General Principles of Reconnaissance

Engineer reconnaissance missions are of

two types. *General* engineer reconnaissance provides engineer information of a general character within a defined area. *Special* reconnaissance obtains data regarding a definite task or tasks. General reconnaissance is initiated as soon as the organization enters the area in which it is to conduct operations. General reconnaissance surveys the availability of local engineer materials, equipment, and water; collects terrain data; and assists in solving operational problems of immediate concern. It is followed by special reconnaissance to obtain more detailed data in the support of specific tasks. Occasionally, a reconnaissance party may be directed to perform both general and special reconnaissance.

11-5. Personal Reconnaissance by Commanders

The reconnaissance activities thus far described in this section are for the purpose of supplying information to subordinate commanders. It should not be assumed, however, that reconnaissance by intelligence personnel is a substitute for the personal reconnaissance of a unit commander. Each commander should personally reconnoiter the area and sites of operations as fully as time will allow. This personal observation enables him, at a later date, to visualize the situation for a more complete understanding and interpretation of the reports which he receives, and helps him to formulate his directives and review the plans

and orders framed by his staff. Personal reconnaissance follows no definite pattern. It should be planned and purposeful, and observations should be recorded. The commander may designate subordinate commanders or staff officers to accompany him.

11-6. Air Reconnaissance

One of the most important uses of the helicopters operated by the aviation platoon of the group headquarters is in reconnaissance. Reconnaissance by air has a great advantage in the speed with which large areas can be covered and the ease with which otherwise inaccessible areas can be reached. Typical missions employing air reconnaissance are:

- a. Reconnaissance of roads, railroads, inland and coastal waterways, bridges, and river-crossing sites.
- b. Reconnaissance of barrier lines, minefields, and roadblocks.
- c. Locating and estimating quantities of engineer materials, including rock, sand and gravel, and timber.
- d. Checking terrain maps for accuracy, sketching local areas, and taking photographs.
- e. Locating water points, bivouac areas, and air landing facilities.
- f. Locating beach and underwater obstacles.
- g. Locating and observing forest fires.
- h. Reconnoitering sites for use of ADM and obtaining target data.

Section II. SECURITY

11-7. Measures

a. Each commander is responsible for the security of his troops, installations, and lines of communication. Security measures embrace all means of preventing enemy interference, surprise, and observation. They include active measures involving the use of security detachments, and passive measures such as concealment, dispersion, and the use of obstacles and warning systems.

b. The extent of security measures is in proportion to the threat. Security detachments weaken the working strength of the command. The degree of security provided at any site must be carefully evaluated to prevent undue diver-

sion of construction manpower. Elements of the engineer combat battalion normally operate in locations in which considerable security is afforded by other troops on their front and flanks. Their principal concern is usually attack by dismounted patrols, motor or mechanized raids, air attacks, and actions by irregular forces (FM 31-15).

11-8. Security on the March

a. On the march, security to the front is afforded by an advance guard. The mission of the advance guard is to secure the uninterrupted advance of the main body; to protect the main body against surprise; to facilitate the advance by removal of obstacles and road

and bridge repair; and to cover the deployment of the main body if it is committed to action. The strength of the advance guard varies with the size of the command and the nature of the resistance to be expected. For a battalion, the advance guard normally does not exceed one company and for a company, one platoon. A company acting as an advance guard sends forward an advance party of one platoon, which, in turn sends out an advance guard point of one squad. Distances between elements depend upon the terrain, visibility, and speed of movement. In general, distances are the minimum necessary to prevent the surprise of successive elements.

b. Security against attack from the rear is obtained by a rear guard organized similarly to the advance guard but disposed to the rear of the main body.

c. Flank security for the battalion and lesser elements is obtained by continuous observation to the flanks. If parallel routes exist, flank patrols may be dispatched to afford flank security.

d. A column on the road, particularly a motorized column, is extremely vulnerable to sudden attacks by low-flying enemy aircraft. When the danger is great, night marches are the rule. When movements are made in daylight, the distances between vehicles are increased as much as is permitted by the necessity for mutual support and control of the column.

11-9. Security in Bivouac

a. Security in bivouac is afforded by a covering detachment called an outpost. A fully organized outpost consists of outguards, support for each group of outguards, and a reserve. Outguards are usually located on principal avenues of approach. Each outguard provides sentries forward of its position and maintains contact by patrols. A battalion in bivouac may need as much as one company on outpost; and a company, one platoon; but these requirements may often be reduced. Machineguns and rocket launchers are disposed behind the line of outguards with fields of fire to cover approaches. Roadblocks, wire, and minefields are valuable aids to a defensive position and are used when the time and labor involved in plac-

ing and removing them is commensurate with the protection required. Means of rapid communication between elements of the outpost system and from the elements to the main body are provided in order to insure timely warning. Radio, messengers, visual, and sound signals are used.

b. The group headquarters and headquarters company and the separate companies assigned or attached to the group constitute in a sense a separate component command of the group. In most situations, all or most of the separate companies will be located near group headquarters in the rear of the group area. These companies, along with the group headquarters and headquarters company, are regarded as a battalion with respect to movements, security, camouflage, and defense against chemical, biological, and radiological attack.

c. Battalions are usually located at some distance from group headquarters. They are responsible for their own security, and they establish and conduct security measures as required in coordination with other units in the area. Occasionally, when working close together, some coordination between battalions by the group commander may be advisable; however, battalion commanders are responsible for coordinating their security plans without the intercession of group headquarters. In some situations, when engineer missions require the uninterrupted and undivided effort of engineer elements, the group commander should attempt to arrange with the commander of the supported unit for the assignment of the security mission to other troops.

d. Group headquarters and adjacent separate companies may occasionally be covered by the security system set up by security troops for the protection of corps and army headquarters, service troops, and installations; however, this is normally not the case. If the group headquarters and separate companies are not otherwise protected, security must be organized with personnel and weapons of the separate companies. In any of these cases, special attention should be given to the protection of the equipment of the separate companies against air attack and against damage, destruction, and theft of essential parts by irregular forces.

11-10. Security at Worksites

a. Security detachments are posted to cover the approaches to worksites and to withstand minor harassments and prevent surprise. The number of men in such detachments is kept to a minimum by making use of organic communication equipment and weapons supplemented by roadblocks, wire obstacles, and mines (FM 5-15, FM 5-31, and FM 20-32). Engineer troops of the work party must keep their weapons close at hand and must be prepared to assemble and deploy quickly on warning.

b. As protection against air attack, vehicles and equipment are dispersed and concealed when not in use (FM 5-20). Provision is made for warning by gong, siren, or other means. When the alarm is given, troops disperse and take cover. They return to work promptly when the danger is past. Observers must be well trained in the identification of aircraft and must be cautioned not to interrupt the work by sounding the alarm for aircraft which are too high or too distant or which are of a type unlikely to attack.

11-11. Activity by Irregular Forces

a. Irregular forces are armed individuals or

groups who are not members of regular armed forces. Their activities are characterized by raids, ambushes, and attacks on communications and installations, both in force and in small parties. Their efforts are usually directed against rear areas. If irregular forces are active, the menace must not be underrated. They frequently act spasmodically; and troops in rear areas may acquire a false sense of security, which must be countered by strict supervision of security discipline.

b. Normal security measures are taken to guard against irregular attacks; special attention is given to the security of arms, ammunition, and other equipment of value. The commander must post an adequate guard to insure security. Tripwires and other devices may be installed to prevent approach without alarm. Personnel must keep their weapons close at hand and practice assembly for instant action. Security dispositions are frequently altered since they may be subject to observation. Natives are not permitted to enter sensitive areas. All natives in the area are considered suspect. For further information, see FM's 31-15 and 31-21.

APPENDIX

REFERENCES

1. DA Pamphlets

DA Pam 20-21 The Army School Catalog.
DA Pam 108-1 Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam in the 310-series pertinent to administration, training, maintenance, and supply.
DA Pam 750-1 Preventive Maintenance Guide for Commanders.

2. Army Regulations and Special Regulations

AR 25-20 Investigation and Processing of Claims.
AR 320-5 Dictionary of United States Army Terms.
AR 320-50 Authorized Abbreviations and Brevity Codes.
AR 385-40 Accident Reporting and Records.
AR 385-55 Prevention of Army Motor Vehicle Accidents.
AR 611-101 Manual of Commissioned Officer Military Occupational Specialties.
AR 611-112 Manual of Warrant Officer Military Occupational Specialties.
AR 611-201 Manual of Enlisted Military Occupational Specialties.
AR 735-35 Supply Procedures for TOE Units, Organizations, and Non-TOE Activities.
AR 750-8 Command Maintenance Management Inspections.

3. Field Manuals

FM 3-10 Chemical and Biological Weapons Employment.
FM 3-12 Operational Aspects of Radiological Defense.
FM 5-1 Engineer Troop Organization and Operations.
FM 5-15 Field Fortifications.
FM 5-20 Camouflage, Basic Principles and Field Camouflage.
FM 5-25 Explosives and Demolitions.
FM 5-26 (S) Employment of Atomic Demolition Munitions (ADM) (U).
FM 5-30 Engineer Intelligence.
FM 5-31 Use and Installation of Boobytraps.
FM 5-34 Engineer Field Data.
FM 5-35 Engineers' Reference and Logistical Data.
FM 5-36 Route Reconnaissance and Classification.
FM 5-135 Engineer Battalion, Armored, Mechanized and Infantry Divisions.
FM 5-136 Engineer Battalion, Airborne Division.
FM 5-144 Engineer Shore Assault Units.
FM 5-146 Engineer Topographic Units.
FM 5-162 Engineer Construction and Construction-Support Units.
FM 7-11 Rifle Company, Infantry, Airborne Infantry, and Mechanized Infantry.
FM 7-15 Infantry, Airborne Infantry and Mechanized Infantry, Rifle Platoons and Squads.
FM 7-20 Infantry, Airborne Infantry, and Mechanized Infantry Battalions.
FM 7-30 Infantry, Airborne, and Mechanized Division Brigades.
FM 8-10 Medical Service, Theater of Operations.

FM 8-15	Division Medical Service, Infantry, Airborne, Mechanized, and Armored Divisions.
FM 8-16	Medical Service, Field Army.
FM 11-86	Combat Area Signal Battalion Army.
FM 11-95	Army Signal Battalion.
FM 20-32	Land Mine Warfare.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 21-40	Small Unit Procedures in Chemical, Biological, and Radiological (CBR) Operations.
FM 24-18	Field Radio Techniques.
FM 24-20	Field Wire Techniques.
FM 30-5	Combat Intelligence.
FM 30-10	Terrain Intelligence.
FM 31-10	Barriers and Denial Operations.
FM 31-15	Operations Against Irregular Forces.
FM 31-16	Counter guerrilla Operations.
FM 31-21	Guerrilla Warfare and Special Forces Operations.
FM 31-22	US Army Counterinsurgency Forces.
FM 31-25	Desert Operations.
FM 31-30	Jungle Operations.
FM 31-50	Combat in Fortified and Built-up Areas.
FM 31-60	River-Crossing Operations.
FM 31-70	Basic Cold Weather Manual.
FM 31-71	Northern Operations.
FM 31-72	Mountain Operations.
FM 61-100	The Division
FM 100-5	Field Service Regulations; Operations.
FM 100-10	Field Service Regulations; Administration.
FM 101-5	Staff Officers' Field Manual, Staff Organization and Procedure.
FM 101-10	Staff Officers' Field Manual, Organization, Technical and Logistical Data.

4. Technical Manuals

TM 3-210	Fallout Prediction.
TM 5-210	Military Floating Bridge Equipment.
TM 5-216	Armored Vehicle Launched Bridge.
TM 5-260K	Bridge Model, Training Aid Kit, Timber Trestle, Class 50/80.
TM 5-277	Panel Bridge, Bailey Type, M2.
TM 5-285	Semipermanent Highway Steel Bridges, 30-, 60-, and 90-Foot Spans.
TM 5-286	Semipermanent Highway and Railway Trestle Bridges.
TM 5-302	Construction in the Theater of Operations.
TM 5-312	Military Fixed Bridges.
TM 5-330	Planning, Site Selection, and Design of Roads, Airfields, and Heliports in the Theater of Operations.
TM 5-331	Management; Utilization of Engineer Construction Equipment.
TM 5-374	Light Standard and Standard Unit Steel Trestles.
TM 5-700	Field Water Supply
TM 21-300	Driver Selection and Training (Wheeled Vehicles).
TM 38-750	Army Equipment Record System and Procedures.

5. Training Circulars

TC 5-2 Employment of Mobile Assault Bridging.

6. Army Training Tests

ATT 5-35-1 Engineer Battalion, Combat, Army.

ATT 5-137 (5-77) Engineer Company, Panel Bridge.

ATT 5-138 (5-78) Engineer Company, Float Bridge.

ATT 5-367 (5-54) Engineer Light Equipment Company.

7. Army Training Programs

ATP 5-35 Nondivisional Engineer Combat Units.

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By Order of the Secretary of the Army:

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General, United States Army,
Chief of Staff.

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Major General, United States Army,
The Adjutant General.

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NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

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For explanation of abbreviations used, see AR 320-50.

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